

## **Overview**

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NASA's Space Operations Mission Directorate (SOMD) provides space exploration services to NASA customers and other partners in the U.S. and throughout the world. SOMD manages the safe flyout of the Space Shuttle Program (SSP); oversees the operation of the system and payloads on the International Space Station (ISS); provides safe and reliable access to space through the Launch Services Program (LSP); develops and implements future space launch complex upgrades through the 21st Century Space Launch Complex (21st CSLC) Program; manages rocket testing capabilities through the Rocket Propulsion Test (RPT) Program; maintains secure and dependable communications to ground stations and between platforms across the solar system through the Space Communication and Navigation (SCaN) Program; and provides the necessary training and supports the health and safety of our Nation's astronauts through Human Space Flight Operations (HSFO).

The Space Shuttle will be retired before FY 2012 so that NASA can focus on the new challenges facing a 21st century space agency. As a result, the FY 2012 budget for the Space Shuttle Program continues to support the planning, cost-effective utilization, and responsive disposition of processes, personnel, resources, and real and personal property. The majority of requested FY 2012 funds for the Space Shuttle Program are to cover the pension liability for the Space Shuttle Program's prime contractor. The estimated liability is approximately \$550 million as of January 2011 and will continue to fluctuate until formal pension plan termination. If funding remains after the pension plan termination, it will be used to defray Space Shuttle closeout costs that would otherwise require FY 2013 funding; however, if there is a shortfall, it will reduce available Space Shuttle funds for closeout.

The ISS is a unique, international orbital outpost for learning how to live and work in space, and how to perform the scientific and engineering research needed for prolonged stays in low Earth orbit, on the Moon, Mars, or on other bodies. After Shuttle retirement NASA will use commercial and international transportation capabilities to embark on extended and enhanced ISS utilization, focusing on basic scientific research and technology demonstration that will prepare the Agency for future exploration and benefit life on Earth. The Agency will also invest in the Space Station facility itself by initiating new activities to increase functionality. To enhance return on investment, NASA is transferring management of research that is not directly related to the NASA's exploration mission to an independent non-profit organization and has secured partnerships with other U.S. Government agencies and private firms to utilize a portion of the ISS as a National Laboratory.

In addition to these high-profile programs, SOMD ensures that the critical infrastructure to access and use space is available to meet the needs of NASA's internal and external customers. The Space and Flight Support (SFS) budget is comprised of multiple programs providing Agency-level enabling capabilities that play a critical role in the success of NASA missions and goals.

- The SCaN Program operates NASA's extensive network of terrestrial and orbiting communications nodes and the associated hardware and software needed to pull down the terabytes of data generated by NASA's fleet of crewed vehicles and robotic spacecraft.
- LSP facilitates access to space by providing leadership, expertise and cost-effective Expendable Launch Vehicle (ELV) services for NASA's missions.
- The RPT Program maintains NASA's wide variety of test facilities for use by NASA, other agencies, and commercial partners.
- The HSFO Program ensures that NASA's astronauts are fully prepared for current and future missions.
- NASA is also planning to continue 21st century space launch complex modernization program at the

**Mission Directorate: Space Operations**

Kennedy Space Center (KSC), which will benefit current and future NASA and commercial space launch activities and other complex users.

- Mission Operations Sustainment provides support for essential human spaceflight activities by addressing space operations requirements and risks for which precise costs cannot be known until after formal technical requirements, risk management approaches, and cost estimates are prepared.

With the upcoming retirement of the Space Shuttle, planning is underway which will lead to SOMD and the Exploration Systems Mission Directorate (ESMD) merging to create a new directorate. The resulting organization will implement the human spaceflight program content, in alignment with the goals of the NASA Authorization Act of 2010. The new organization will manage the ISS, Commercial Crew and Cargo, Space Launch System and Multi-Purpose Crew Vehicle, and Exploration Research and Development.

**FY 2012 Budget Request**

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	Auth Act FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>6,141.8</u></b>	<b><u>6,146.8</u></b>	<b><u>5,508.5</u></b>	<b><u>4,346.9</u></b>	<b><u>4,346.9</u></b>	<b><u>4,346.9</u></b>	<b><u>4,346.9</u></b>	<b><u>4,346.9</u></b>
Space Shuttle	3,101.4	-	-	636.8	65.8	0.0	0.0	0.0
International Space Station	2,312.7	-	-	2,667.0	2,775.8	2,818.0	2,847.3	2,883.8
Space and Flight Support (SFS)	727.7	-	-	699.8	1,156.8	1,168.7	1,122.2	1,067.5
SOMD Civil Service Labor and Expenses	0.0	-	-	343.4	348.5	360.2	377.5	395.6

*Note:*

*The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.*

*The "Auth. Act FY 2011" column represents FY 2011 authorized funding from the NASA Authorization Act of 2010 (P.L. 111-267).*

*In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.*

**Plans for FY 2012**

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**Space Operations**

**Space Shuttle**

*New Initiatives:*

None

*Major Changes:*

The FY 2012 budget represents a decrease from FY 2011 due to the completion of the Space Shuttle manifest. Only transition and retirement activities remain funded in FY 2012. The majority of requested FY 2012 funds for SSP are to cover the pension liability for SSP's prime contractor. The estimated liability of approximately \$550 million as of January 2011 will continue to fluctuate until formal pension plan termination. If funding remains after the pension plan termination, it will be used to defray Space Shuttle closeout costs that would otherwise require FY 2013 funding; however, if there is a shortfall, it will reduce available Space Shuttle funds for closeout and some activity could move later than planned.

*Major Highlights for FY 2012*

The Space Shuttle is scheduled to fly the last mission in FY 2011. Disposition of property and capabilities no longer needed for safe mission execution has been underway for some time and culminates with the disposition of most Space Shuttle assets by the end of FY 2013.

**International Space Station**

*New Initiatives:*

None

*Major Changes:*

None

*Major Highlights for FY 2012*

ISS will serve as a fully functional and continuously crewed research laboratory, orbital observatory, and technology test bed providing a critical stepping stone for exploration and future international cooperation.

To increase the return on investment and further U.S. research productivity, NASA is awarding a cooperative agreement to an independent organization with the responsibility to further develop national uses of ISS through partnerships with NASA researchers, other U.S. Government agencies, private firms, and non-profit institutions.

**Space and Flight Support (SFS)**

*New Initiatives:*

Beginning in FY 2013, a new Mission Operations Sustainment line provides support for essential human space flight activities, by addressing space operations requirements and risks for which precise costs cannot be known until after formal technical requirements, risk management approaches, and cost estimates are prepared.

*Major Changes:*

None

*Major Highlights for FY 2012*

SCaN's major milestone in FY 2012 will be to complete the delivery of the Tracking and Data Relay Satellite (TDRS) K spacecraft as part of the TDRS Replenishment project. The project is responsible for the acquisition of two new tracking and data relay satellites, TDRS-K and TDRS-L, to replenish the aging fleet of communications spacecraft in the Space Network. The TDRS Replenishment project office at the Goddard Space Flight Center (GSFC) is managing the procurement, which includes on-orbit delivery, and acceptance of the two spacecraft: TDRS-K to be launched in December 2012 (or as early as April 2012), followed by launch of TDRS-L in December 2013.

LSP provides a reliable service that gets the satellites into orbit. It has five such planned NASA launches in FY 2012.

RPT facilities are part of the critical path for the development of future propulsion technologies required to support developing vehicle architectures. RPT will continue to utilize available resources to improve aging infrastructure in preparation of future propulsion test requirements.

HSFO is comprised of Space Flight Crew Operations (SFCO) and Crew Health and Safety (CHS). For FY 2012, SFCO will provide crew expertise for future vehicle development and four ISS long-duration crew rotation missions by providing and maintaining an adequate number of astronauts with appropriate skills and experience to conduct planned research and maintenance activities. NASA has enlisted the National Academies in FY 2011 to conduct an independent study of the activities funded within NASA's HSFO Program after the Space Shuttle is retired.

The 21st CSLC Program will continue to develop and establish necessary partnerships, to gain an understanding of evolving requirements from the users of the Florida launch and range complex at KSC. In 2012, CSLC expects to begin work on several projects to improve the launch and range complex. Areas under consideration include modernization activities to support safer and more efficient launch operations, enhancing payload processing capabilities, relocating the KSC perimeter to facilitate certain private sector activities and operations; environmental remediation, and supporting the modernization of the launch range capabilities. The 21st CSLC Program will also develop a cost-effective ground infrastructure plan that considers the Space Launch System and potential ground investment activities with the NASA Centers.

## Theme Overview

Thirty-eight years ago, NASA was charged with developing the world's first reusable space transportation system, a powerful vehicle with the versatility to revolutionize how people access and operate in near-Earth space. Since 1981, the Space Shuttle has carried more people (over 350) and more cargo (almost four million pounds) on more (and different types of) missions than any other launch system in history. For the past 13 years, the full capabilities of the Space Shuttle have been applied to the mission for which the system was originally conceived and uniquely designed: assembly of a large, advanced research station in low Earth orbit (LEO), one which can serve as a critical international research technology test bed to help NASA and its partners learn how humans can live in space and to prepare for further missions out to the Moon, to Mars, and beyond. In FY 2011, the Space Shuttle will retire, marking the end of its chapter in the history of space exploration. As NASA continues Space Shuttle Transition and Retirement (T&R) activities in FY 2012, the Agency is transitioning key workforce, technology, facilities, and operational experience to a new generation of human space flight exploration activities. However, the recent delay in the completion of the manifest until later in FY 2011 than originally planned has required the program to reevaluate the final completion date, with some disposition activities moving into FY 2013. The majority of requested FY 2012 funds for SSP are to cover the pension liability for the program's prime contractor. The estimated liability of approximately \$550 million as of January 2011 will continue to fluctuate until formal pension plan termination. If funding remains after the pension plan termination, it will be used to defray Space Shuttle closeout costs that would otherwise require FY 2013 funding; however, if there is a shortfall, it will reduce available Space Shuttle funds for closeout and some activity could move later than planned.

For more information, please visit <http://www.nasa.gov/shuttle>.

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>3,101.4</u></b>	<b>-</b>	<b><u>636.8</u></b>	<b><u>65.8</u></b>	<b><u>0.0</u></b>	<b><u>0.0</u></b>	<b><u>0.0</u></b>
Space Shuttle Program	3,101.4	-	636.8	65.8	0.0	0.0	0.0

**Note:**

The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the program amounts shown above. The allocation to each program is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

## Plans for FY 2012

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### Space Shuttle Program

The Space Shuttle is scheduled to fly its last mission in FY 2011. Disposition of property and capabilities no longer needed for safe mission execution has been underway for some time. With the launch of STS-134 moved to no earlier than April 2011 and the potential of launching the authorized, yet-to-be funded STS-135 in June 2011, some Shuttle property disposition activity may continue into FY 2013. The majority of requested FY 2012 funds for the SSP are to cover the pension liability for SSP's prime contractor. The estimated liability of approximately \$550 million as of January 2011 will continue to fluctuate until formal pension plan termination. If funding remains after the pension plan termination, it will be used to defray Space Shuttle closeout costs that would otherwise require FY 2013 funding; however, if there is a shortfall, it will reduce available Space Shuttle funds for closeout and some activity could move later than planned.

## Relevance

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### ***Relevance to national priorities, relevant fields, and customer needs:***

With the completion of ISS assembly and the retirement of the Space Shuttle, NASA is transferring key program assets to programs and operations that will support the next generation of human space exploration activities. This transfer will safeguard the long-term viability of key and enabling technical capabilities, while capabilities that are no longer needed or are obsolete will be retired or transitioned to other users.

### ***Relevance to the NASA Mission and Strategic Goals:***

SSP supports the Agency Strategic Goal 1 to "Extend and sustain human activities across the solar system," by transitioning needed assets and capabilities for use in future NASA programs or other organizations.

### ***Relevance to education and public benefits:***

Space Shuttle assets and capabilities are being assessed for use in future NASA programs. Where those capabilities have a future use, they are being transferred to the relevant NASA programs. For those capabilities without a future use, NASA is partnering with the General Services Administration and other organizations to ensure assets are dispositioned in accordance with all relevant Federal regulations and statutes. Through the authority of the Stevenson-Wydler Act, NASA is making special accommodations so that schools and accredited museums have first priority in acquiring Space Shuttle property for educational purposes.

## Performance

### Performance Commitments:

Measure #	Description	Contributing Program (s)
Strategic Goal 1	Extend and sustain human activities across the solar system.	
Outcome 1.1	Sustain the operation and full use of the International Space Station (ISS) and expand efforts to utilize the ISS as a National Laboratory for scientific, technological, diplomatic, and educational purposes and for supporting future objectives in human space exploration.	
Objective 1.1.1	Maintain resources (on orbit and on the ground) to operate and utilize the ISS.	
Performance Goal 1.1.1.2	<i>HPPG: Safely fly out the Space Shuttle manifest and retire the fleet.</i>	
APG 1.1.1.2: SSP-12-1	Ensure the Space Shuttle Endeavour is ready for transport to its final display location.	Space Shuttle Program

### Performance Achievement Highlights:

The Space Shuttle safely and successfully completed every mission objective for all four flights in FY 2010. With construction of ISS nearly complete, the focus of the Space Shuttle flights to ISS in FY 2010 shifted predominately to provisioning ISS to support operations and utilization through the next 10 years and beyond.

- STS-129, launched on November 16, 2009, focused on staging spare components on the outside of ISS, including gyroscopes, nitrogen and ammonia tank assemblies, pump modules, and end effectors for the ISS robotic arm.
- STS-130, launched on February 8, 2010, saw the delivery and installation of the Tranquility (formerly Node 3) module and the Cupola. The name for the Tranquility module was suggested through a NASA public outreach effort, tying together the installation of the last planned U.S. pressurized module with history of space exploration and the landing of Apollo 11 at Tranquility Base on the Moon in July 1969.
- STS-131, launched on April 5, 2010, carried the Italian-built Multi-Purpose Logistics Module, Leonardo, loaded with eight tons of science equipment and cargo. Leonardo will return to the ISS one last time on STS-133 when it is permanently installed to the ISS.
- STS-132, launched on May 14, 2010, was the final mission of FY 2010. It carried the final scientific module destined for ISS, the Russian Rassvet Mini Research Module, as well as over 5,300 pounds of external supplies on an Integrated Cargo Carrier Vertical Light Deployable pallet in the Space Shuttle cargo bay.
- Also the last set of Reusable Solid Rocket Motors (RSRM-114) and the last production External Tank (ET-138) were delivered to KSC in FY 2010.

***Independent Reviews:***

<b>Review Type</b>	<b>Performer</b>	<b>Last Review</b>	<b>Purpose/Outcome</b>	<b>Next Review</b>
Other	NASA Advisory Council	10/2010	Provides independent guidance for the NASA Administrator. No recommendations were provided to SSP at this time.	02/2011
Other	Aerospace Safety Advisory Panel (ASAP)	10/2010	Provides independent assessments of safety to the NASA Administrator. In their 2008 Annual Report, ASAP stated that they "strongly endorse the NASA position on not extending Shuttle operations beyond successful execution of the December 2008 manifest, completing the ISS." NASA will fly the Space Shuttle to complete the ISS and then retire the Shuttle. ASAP did, however, endorse the NASA position that it is acceptable to undertake the STS-135 mission.	02/2011
Other	NASA Engineering and Safety Center	09/2010	The NASA Engineering and Safety Center conducted a review independent of SSP of the relative safety of proceeding with the STS-135 mission without a typical, Shuttle-based rescue mission. They stated that using a smaller crew and a Soyuz-based rescue approach is no riskier than a Shuttle-based rescue.	



**Mission Directorate:** Space Operations  
**Theme:** Space Shuttle  
**Program:** Space Shuttle Program

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>3,101.4</u></b>	<b>-</b>	<b><u>636.8</u></b>	<b><u>65.8</u></b>	<b><u>0.0</u></b>	<b><u>0.0</u></b>	<b><u>0.0</u></b>
SPOC Pension Liability	0.0	-	547.9	0.0	0.0	0.0	0.0
Program Integration	627.2	-	24.8	21.3	0.0	0.0	0.0
Flight and Ground Operations	1,115.4	-	27.9	17.0	0.0	0.0	0.0
Flight Hardware	1,358.8	-	36.1	27.6	0.0	0.0	0.0

**Note:**

NASA will work with the Administration and Congress to determine the highest priority use of the FY 2011 funds if they are not required to fly the Shuttle in the first quarter of FY 2011.

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In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space Shuttle
<b>Program:</b>	Space Shuttle Program

## **Project Descriptions and Explanation of Changes**

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### ***Program Integration***

The FY 2012 SSP Integration budget supports Space Shuttle retirement and the efficient and cost-effective transition of assets to other uses once they are no longer needed for safe Shuttle mission execution. Program Integration ensures the overall safety and efficiency of Space Shuttle T&R activities, including software support, systems engineering, and business management. Program Integration T&R funding also covers severance and retention costs associated with managing the drawdown of the Space Shuttle workforce.

### ***Flight and Ground Operations***

The FY 2012 Flight and Ground Operations budget ensures the availability of resources needed to identify, process, safe, and transfer flight and ground processing assets once they are no longer needed for safe SSP mission execution. The T&R budget includes funds needed to prepare assets (e.g., Mission Control Center, the launch pads, the Vehicle Assembly Building, and the Launch Control Center) for modification, transfer to other users, or disposal. The Mobile Launch Platforms, the Orbiter Processing Facilities, and landing site hardware no longer needed by NASA will be made safe of hazardous materials and prepared for transfer to other Federal Government users or other disposition.

### ***Flight Hardware***

The FY 2012 Flight Hardware T&R budget provides resources needed to identify, process, safe, and transfer flight hardware assets once they are no longer needed for safe Shuttle mission execution. For orbiters, these costs include safing the vehicles of hazardous materials. For the main engines, these costs also include safing and transportation preparation of current and older engine components that are being made available for alternate use or public display. The Flight Hardware T&R budget also covers the costs of dispositioning orbiter, Space Shuttle main engine, external tank, and reusable solid rocket motor production tooling capabilities that the Agency will no longer need.

### ***Space Program Operations Contract (SPOC) Pension Liability***

The FY 2012 Pension Liability budget provides funding under the SPOC as a contractually reimbursable cost of their defined benefit pension plans. United Space Alliance, LLC (USA), the NASA incumbent contractor for SPOC under SSP, after negotiation with the Agency, agreed to freeze the plans as of December 31, 2010, and delay formal pension plan termination until after the completion of the Space Shuttle manifest. USA does not expect to have sufficient funding available to irrevocably settle all benefit obligations of the plans. Per Federal Cost Accounting Standards (which govern the allowability of contract costs) 413-50(c)(12)(vi), the Government's share on an adjustment "may be recognized by modifying a single contract, several but not all contracts, or all contracts, or by use of any other suitable technique."

Due to the overwhelming majority of USA underfunded pension liability being attributed to the SPOC, all allowable costs associated with the termination of the qualified plans will be recognized on the SPOC, and the responsibility of the Government. The estimated liability of approximately \$550 million as of January 2011 will continue to fluctuate until formal pension plan termination. If funding remains after the pension plan termination, it will be used to defray Space Shuttle closeout costs that would otherwise require FY 2013 funding; however, if there is a shortfall, it will reduce available Space Shuttle funds for closeout and some activity could move later than planned.



**Mission Directorate:** Space Operations  
**Theme:** Space Shuttle  
**Program:** Space Shuttle Program

### Program Management

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The SSP Manager reports to the Associate Administrator for Space Operations at NASA Headquarters.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Program Integration	Johnson Space Center	Johnson Space Center	N/A
Flight and Ground Operations	Kennedy Space Center	Kennedy Space Center and Johnson Space Center	N/A
Flight Hardware	Johnson Space Center	Johnson Space Center and Marshall Space Flight Center	N/A

### Acquisition Strategy

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The SPOC prime contractor is USA. Other prime contractors are ATK Thiokol (reusable solid rocket motors), Lockheed Martin (external tanks), and Pratt & Whitney-Rocketdyne (Space Shuttle main engines).

## **Theme Overview**

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The ISS orbits the Earth 16 times a day at a speed of 17,500 miles per hour and an altitude that ranges from 230 to 286 miles. The ISS is a research and development test bed that is in itself, an experiment in the design, development, and assembly of an orbital space facility. The ISS serves as a habitat for its crew, a command post for orbital operations, and a port for the rendezvous and berthing of smaller orbiting vehicles. It functions as an orbital microgravity and life sciences laboratory, a test bed for new technologies (e.g., life support and robotics), a platform for astronomical and Earth observations, and a market and destination for the burgeoning commercial crew and cargo transportation industry. The ISS has been continuously crewed since November 2000. Through calendar year (CY) 2010, there were 106 U.S. and international partner flights to ISS, including missions for assembly, crew rotation, and logistical support. At the time of the Space Shuttle retirement, ISS assembly will be complete and the ISS will be composed of approximately 1,000,000 pounds of hardware brought to orbit over the course of more than a decade. ISS is the largest human-made object ever to orbit Earth.

The ISS Program is among the largest international cooperative endeavors in the history of science and technology. The ISS international partnership is composed of NASA, the Canadian Space Agency, the European Space Agency, the Japanese Aerospace Exploration Agency, and the Russian Federal Space Agency. International participation in the program has significantly enhanced the capabilities of the ISS.

In accordance with the NASA Authorization Act of 2010, the ISS will continue through 2020 or beyond. The orbiting facility will support basic and applied research, exploration technology development, and demonstrations, and will be a market and destination to spur the development of a robust commercial crew and cargo transportation services. ISS functionality will be increased--an investment in the facility itself--and will also be utilized to develop and demonstrate in-space human and robotic servicing and repair capabilities which could ultimately be used to support on-orbit servicing and repair of future observatory-class scientific spacecraft.

NASA is in the process of creating an independent, non-profit organization (NPO) to manage and oversee ISS National Laboratory research by U.S. organizations other than NASA. This entity will be responsible for maximizing the value of ISS to the Nation by developing and managing a diversified research and development portfolio based on U.S. national needs for basic and applied research, with the goal of increasing the return on the U.S. investment in the ISS.

NASA has already secured partnerships with other U.S. Government agencies and private firms to use a portion of the ISS as a National Laboratory (per the NASA Authorization Act of 2005). NASA's plan for the ISS National Laboratory, "National Lab Report," was submitted to Congress in May 2007. Approximately 50 percent of planned U.S. resources and accommodations on ISS could be available for use by organizations other than NASA. Firm interest in ISS use has been expressed by organizations representing education, human health, plant and animal biotechnologies, aerospace technologies, and defense sciences research. NASA has signed Memoranda of Understanding (MOUs) for use of the ISS with the National Institutes of Health (NIH) and the Department of Agriculture (USDA), and has pre-existing agreements with the Department of Energy (DOE), DoD, and the National Science Foundation (NSF). In addition, NASA re-issued an announcement of "Opportunity for Use of the ISS by Non-Government Entities for Research and Development and Industrial Processing Purposes," in August 2009. To date, NASA has entered into Space Act Agreements (SAA) with seven private firms and two universities. Additional MOUs and SAAs are in various stages of discussion.

<b>Mission Directorate:</b>	<b>Space Operations</b>
<b>Theme:</b>	<b>International Space Station</b>

### FY 2012 Budget Request

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International Space Station Program	2,312.7	-	2,667.0	2,775.8	2,818.0	2,847.3	2,883.8

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## **Plans for FY 2012**

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### **International Space Station Program**

NASA will focus on increasing research, continuing safe operations, and utilizing the ISS to its full capacity as a test bed for exploration technology demonstrations and development. These efforts are intended to revitalize, enhance, and augment the ISS Program and are discussed below.

Section 503 of the NASA Authorization Act of 2010 states: "The Administrator shall take all actions necessary to ensure the safe and effective operation, maintenance and maximum utilization of the United States segment of the ISS through at least September 30, 2020."

NASA will also invest in the ISS facility itself by initiating new activities to revitalize ISS and increase functionality. The activities are intended to support ISS upgrade efforts while proving new space technologies, reducing costs, and increasing functionality. Potential objectives include lowering costs or increasing the efficiency of ISS operations in space or on the ground, reducing demands on crew time, improving ISS safety, and supporting activities benefiting future exploration programs or capabilities. ISS is a major asset for demonstrating technologies and capabilities that are funded and operated by NASA and other sponsors. ISS will enhance the Nation's ability to operate future human space flight activities and make space exploration more affordable and effective. The ISS Program will facilitate National Laboratory research and engineering activities consistent with Agency objectives.

The ISS will be utilized to conduct multidisciplinary science, technology, and applications development and operate as an outpost for human exploration. In FY 2011, NASA will begin operations on new external unpressurized payloads, including the Alpha Magnetic Spectrometer (AMS) particle physics detector, a communications navigation and networking demonstration, and an advanced materials technology test bed.

Additionally, internal pressurized payloads scheduled for FY 2012 will include ongoing studies to support NASA's human research program for exploration. NASA will continue National Laboratory collaborations with: the NIH, DoD, DOE, NSF; private industry collaborations including Astrogenetix, Inc., and Ad Astra Rocket Company; academic institutions such as University of Colorado-Bioserve; and other agencies supporting science, technology, engineering, and mathematics (STEM) education.

The independent non-profit organization will be operational in FY 2012. It will identify the unique capabilities of the ISS that provide breakthrough opportunities for non-NASA uses in science and applications, technology development, and STEM education, including but not limited to human health, biological sciences, biotechnology, biological research, energy and biofuels, physical and materials science and development, engineering research and technology development, and Earth and space imaging and observations. They will also formulate a comprehensive portfolio of activities to maximize the value of the ISS as a venue for STEM education.

Space Operations provides for crew and cargo transportation services to and from the ISS. The Commercial Resupply Services (CRS) contracts awarded to SpaceX and Orbital Sciences are scheduled to provide commercial resupply flights beginning in CY 2011. Cargo transportation to the ISS will also be supplemented by the Japanese HII Transfer Vehicle (HTV) and European Automated Transfer Vehicle (ATV). Crew transportation and rescue will be provided by the Russian Soyuz vehicle until domestic transportation providers are available by 2016. The Exploration Systems Mission Directorate (ESMD) budget includes funding to facilitate the development of a U.S. commercial crew space transportation capability with the goal of achieving safe, reliable, and cost effective access to and from LEO and the ISS.

## Relevance

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### ***Relevance to national priorities, relevant fields, and customer needs:***

NASA leads scientific and technological advances in aeronautics and space for a Nation on the frontier of discovery. ISS is essential in addressing critical health, safety, performance, and cost issues confronting the future of human space flight beyond LEO. ISS supports scientific research and the development of new technologies and capabilities that enable human space exploration and other activities that put humans in space. Research aboard ISS is critical in understanding the effects of space environments on the human body and developing mitigation techniques. Research on ISS will lead to strategies that minimize the logistical burden of supporting humans far from Earth, address remote medical emergencies, and demonstrate enabling technologies for human exploration. NASA and its international partners are applying the information learned to plan for future human and robotic missions. Techniques demonstrated in robotics, assembly, and maintainability on the ISS are guiding development of next-generation space vehicles that will fly farther, faster, and for longer duration.

U.S. Government agencies, private firms, and universities will conduct research on the ISS in its capacity as a National Laboratory. Research will yield important data that address challenges in human health, energy and the environment. The ISS also promotes the commercial space transportation industry by providing a market for crew and cargo transportation. The ISS partnership provides a successful example of peaceful and constructive international cooperation, one that provides tangible benefits here on Earth.

### ***Relevance to the NASA Mission and Strategic Goals:***

ISS supports NASA's Strategic Goal 1 to "Extend and sustain human activities across the solar system." The ISS National Laboratory will enable research for scientific, technological, diplomatic, and educational purposes, support future objectives in human space exploration, allow competitive opportunities for the commercial community to provide best value products and services to LEO and beyond, and lay the groundwork for an integrated architecture and capabilities for safe crew and cargo missions beyond LEO.

ISS also supports NASA's Strategic Goal 5 to "Enable program and institutional capabilities to conduct NASA's aeronautics and space activities," by establishing partnerships with commercial, international, and other government entities in order to maximize mission success.



***Relevance to education and public benefits:***

Research conducted on the ISS offers benefits that cross all areas of American life, including public health, energy, environment, education, and promoting international cooperation. Specific examples include new uses of ultrasound technology, embedded Web technology to allow remote monitoring and control of devices through a Web browser, and scientific discoveries that are helping the medical community understand and mitigate muscle, balance, and bone health issues.

Research performed on the ISS will contribute to a broader understanding of injury and disease with both space and Earth-based medical applications. For example, potential new vaccines for bacteria-induced infectious diseases have been identified through ISS research and scientists will be applying to the Food and Drug Administration for an investigational new drug classification. Ongoing investigations are focused on developing vaccines for salmonella-induced food poisoning and Methicillin resistant *Staphylococcus aureus* (commonly known as MRSA), which has been responsible for over 19,000 U.S. deaths per year, according to the Centers for Disease Control.

The ISS will be used to develop and demonstrate new technologies including closed loop life support systems and remote medical care capabilities, both of which benefit people here on Earth. NASA's water recycling technology is being used to provide potable water to places devastated by natural disasters. NASA will also use the ISS to demonstrate technologies necessary for future space systems such as thermal control, environmental control, and power generation. The onboard crew also utilizes the ISS as a low-cost platform to monitor and record natural and human-driven changes and events on Earth.

Over 10,000 students have participated in ISS-based educational activities. These have ranged from student-developed experiments to interactive classroom video sessions with crewmembers. The ISS has made a consistent contribution to advancing national STEM education objectives.

## Performance

### Performance Commitments:

Measure #	Description	Contributing Program (s)
<b>Strategic Goal 1</b>	<b>Extend and sustain human activities across the solar system.</b>	
<b>Outcome 1.1</b>	<b>Sustain the operation and full use of the International Space Station (ISS) and expand efforts to utilize the ISS as a National Laboratory for scientific, technological, diplomatic, and educational purposes and for supporting future objectives in human space exploration.</b>	
<b>Objective 1.1.1</b>	<b>Maintain resources (on orbit and on the ground) to operate and utilize the ISS.</b>	
<b>Performance Goal 1.1.1.1</b>	<b>Maintain capability for six on-orbit crew members.</b>	
APG 1.1.1.1: ISS-12-1	In concert with the International Partners, maintain a continuous crew presence on the ISS by coordinating and managing resources, logistics, systems, and operational procedures.	International Space Station Program
<b>Performance Goal 1.1.1.3</b>	<b>Provide cargo and crew transportation to support on-orbit crew members and utilization.</b>	
APG 1.1.1.3: ISS-12-2	Fly the ISS spares, logistics, and utilization hardware as agreed to by the International Partners in the ISS transportation plan.	International Space Station Program
APG 1.1.1.3: ISS-12-3	Complete at least two flights to the ISS by U.S. developed cargo delivery systems.	International Space Station Program
<b>Performance Goal 1.1.1.4</b>	<b>Maintain and operate a safe and functional ISS.</b>	
APG 1.1.1.4: ISS-12-4	Provide 100 percent of planned on-orbit resources (including power, data, crew time, logistics, and accommodations) needed to support research.	International Space Station Program
APG 1.1.1.4: ISS-12-5	Achieve zero Type-A (damage to property at least \$1 million or death) or Type-B (damage to property at least \$250 thousand or permanent disability or hospitalization of three or more persons) mishaps.	International Space Station Program
<b>Objective 1.1.2</b>	<b>Advance engineering, technology, and research capabilities on the ISS.</b>	
<b>Performance Goal 1.1.2.1</b>	<b>Advance knowledge of long-duration human space flight by establishing agreements with organizations to enable full utilization of the ISS.</b>	
APG 1.1.2.1: ISS-12-6	Accomplish a minimum of 90 percent of the on-orbit research objectives as established one month prior to a given increment, as sponsored by NASA, baselined for FY 2012.	International Space Station Program

## Performance

### Performance Commitments:

Measure #	Description	Contributing Program (s)
Strategic Goal 5	Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.	
Outcome 5.5	Establish partnerships, including innovative arrangements, with commercial, international, and other government entities to maximize mission success.	
Objective 5.5.1	Facilitate the use of the ISS as a National Laboratory for cooperative research, technology development, and education.	
<i>Performance Goal 5.5.1.1</i>	<i>HPPG: Establish an independent non-profit (NPO) organization to enhance the utilization of the ISS as a National Laboratory.</i>	
APG 5.5.1.1: ISS-12-7	Facilitate non-profit organization (NPO) implementation of its initial grants solicitation process.	International Space Station Program

### Uniform and Efficiency Measures:

Measure #	Description
International Space Station Theme	
APG EFF 1.1.1.4: ISS-12-3	Provide 100 percent of planned on-orbit resources (including power, data, crew time, logistics, and accommodations) needed to support research.
APG EFF 1.1.2.1: ISS-12-6	Accomplish a minimum of 90 percent of the on-orbit research objectives as established one month prior to a given increment, as sponsored by NASA, baselined for FY 2012.

***Performance Achievement Highlights:***

FY 2010 marked completion of the tenth year of continuous human presence in space on the ISS.

During FY 2010, the pace of vehicles visiting the ISS increased:

- Four Space Shuttle flights delivered hardware to and provided logistics support.
- Japan's first HTV successfully completed its mission to unberth from Node 2 and deorbit on October 30, 2009.
- In November 2009, two ExPRESS Logistics Carriers (ELC) were delivered to the ISS and crew members robotically attached them to the ISS truss. The ELCs also carried critical external spares. Also, the Russian Mini-Research Module 2 was launched and docked to the Service Module zenith port to function as a fourth Russian docking port.
- In February 2010, the Tranquility module and Cupola were delivered. The Cupola's multi-directional view allows the crew to control and monitor robotics, spacewalking, and docking operations, and a unique view of Earth and celestial objects. Also, with the arrival of Progress 36P there were four Russian vehicles docked at ISS for the first time. During this period, ISS crews were supported by re-supply and crew rotation using the Space Shuttle, HTV, Russian Progress, and Soyuz vehicles.
- In April and May 2010, vital system spares and research outfitting equipment was delivered. The April mission marked the first time four women and two astronauts from Japan were in space at the same time.
- Research was conducted in biological sciences, human research, technology development, physical sciences, education, and Earth observation. The number of science of technology experiments increased 250, supporting the work of more than 400 researchers worldwide. With delivery of the final 5 research facilities, the full complement of 29 is in place.
- Investigations of the effects of long-duration spaceflight on overall crew health and their re-adaptation to Earth gravity conditions included, analysis of nutritional requirements and food systems, microbes and pathogens, radiation exposure inside ISS modules, and plant growth in microgravity.
- Investigations included high performance nano-materials, physical properties of materials, and materials exposure to the external environment, among them, Hamilton-Sundstrand's successful demonstration of a Sabatier reaction to generate water on-orbit by using waste carbon dioxide and hydrogen from ISS systems.
- Educational experiments and activities provided supplementary K-12 educational opportunities.
- Example pathfinder investigators for the National Lab as included: AstroGenetix, Inc., a company pursuing a series of commercial vaccine experiments on bacterially-induced infectious diseases, including MRSA; a University of Florida and Zero Gravity, Inc. collaborative study of microgravity effects on the *Jatropha curcas* plant and its application as a biofuel; the Naval Research Laboratory's operation of a visible and near-infrared maritime hyperspectral imager for coastal oceans, and a remote atmospheric and ionospheric detector that will conduct the most comprehensive multi-spectral survey of the upper atmosphere in 20 years; and the Defense Department's study of space wound healing, tissue regeneration, and engine exhaust plumes in the upper atmosphere.

<b>Mission Directorate:</b>	<b>Space Operations</b>
<b>Theme:</b>	<b>International Space Station</b>

***Independent Reviews:***

<b>Review Type</b>	<b>Performer</b>	<b>Last Review</b>	<b>Purpose/Outcome</b>	<b>Next Review</b>
Other	ISS Advisory Committee	07/2010	Assess ISS operational readiness to support new crew, assess Russian flight team preparedness to accommodate the Expedition missions, and assess health and flight readiness of Expedition crew members.	Ongoing
Other	NAC	09/2010	Provides independent guidance for the NASA Administrator. The NAC was briefed by the JSC Safety and Mission Assurance Office on NASA lessons learned. The Space Operations committee made two recommendations on NASA utilization of lessons learned, including expanding the teaching aspect.	02/2011
Other	ASAP	10/2010	Provides independent assessments of safety to the NASA Administrator. No recommendations issued relating to ISS.	02/2011
Other	Program Implementation Review	08/2008	Provides an independent review of ongoing ISS and SSP operations. The report cited concerns on budget resources, which have been addressed in this budget and in cargo transportation availability post Shuttle retirement.	2011

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	International Space Station
<b>Program:</b>	International Space Station Program

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>2,312.7</u></b>	<b>-</b>	<b><u>2,667.0</u></b>	<b><u>2,775.8</u></b>	<b><u>2,818.0</u></b>	<b><u>2,847.3</u></b>	<b><u>2,883.8</u></b>
ISS Systems Operations and Maintenance	1,555.2	-	1,291.4	1,425.3	1,385.1	1,449.6	1,526.3
ISS Research	129.5	-	189.8	176.9	178.8	186.1	189.1
ISS Crew and Cargo Transportation	628.0	-	1,185.7	1,173.6	1,254.1	1,211.6	1,168.5

Note:

*The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.*

*In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.*

*In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.*

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	International Space Station
<b>Program:</b>	International Space Station Program

## **Project Descriptions and Explanation of Changes**

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### ***ISS Systems Operations and Maintenance***

The FY 2012 budget extends ISS operations and supports full utilization through at least 2020. This includes: recertification of ISS structures, purchase of additional spares and consumables, extending baseline operational services, enabling services and facilitating National Laboratory partnerships and commitments, and initiating activities that increase ISS upgrade efforts, improve new space technologies, reduce costs, and increase research capacity. Operating the ISS is often more complicated than other space flight endeavors because of its many international partner components. Each ISS partner has the primary authority for managing and operating the hardware it provides, but the various elements provided by the partners are inter-dependent. Oversight by NASA is required to ensure the elements all operate as an integrated system.

ISS Operations Program plans, controls, and executes the ISS program. ISS includes systems engineering, analysis, and integration function entails optimization of the system architecture, integrated system performance and verification analyses, tracking of vehicle configuration, interface requirements, and mission design. The spacecraft function maintains the ISS on orbit in a fully crewed and mission-ready mode. Safety and mission assurance functions implements safety, reliability, maintainability, and quality assurance requirements to ensure that significant risks are reviewed, tracked, and mitigated. Other key operational activities include medical support, and launch site processing of the hardware.

NASA will also invest in the ISS facility itself by initiating new activities to revitalize the ISS and increase functionality. The activities will support ISS upgrade efforts while proving new space technologies, and reducing costs. Potential objectives include increasing the ISS operational efficiency in space or on the ground, reducing demands on crew time, improving safety, and supporting activities to benefit future exploration efforts. Examples include: a common S-band communication system; a common radio frequency/attached audio/video/command/telemetry system; EVA shock hazard improvements and solar array modifications to decrease sensitivities to visiting vehicles flight attitudes and longeron shadowing; mission integration tool enhancements and throughput increases; research results tracking, increased payload integration and verification support; and biotech sample analysis instruments.

Functionality increases will also include development of a docking mechanism to provide compatibility to all visiting vehicles in compliance with the International Docking System Standards. To ensure that the docking system is highly focused on keeping costs low for commercial providers who will use it for their visiting vehicles:

- Design process will be well-coordinated with industry, solicit regular, detailed input, and have a mechanism to resolve industry concerns; and to the degree feasible, the design will be standards-based and not lock the commercial providers into using particular vendors;
- Design will adhere to standard aerospace practices and processes within reach of commercial providers; and
- Necessary and effective cost controls are in place in FY 2012 and the outyears.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	International Space Station
<b>Program:</b>	International Space Station Program

### ***ISS Research***

Having launched the U.S. and international partner elements and established six-person crew capability, the ISS Program focus is now primarily on utilization.

During FY 2011, NASA will be awarding a cooperative agreement to an independent non-profit organization with responsibility to further develop national uses of the ISS. This organization will:

- Act as a single entry point for non-NASA users to interface efficiently with the ISS;
- Assist researchers in developing experiments, meeting safety and integration rules, and acting as an ombudsman on behalf of researchers;
- Perform outreach to researchers and disseminate the results of ISS research activities; and
- Provide easily accessed communication materials with details about laboratory facilities, available research hardware, resource constraints, and more.

The NPO will oversee all research involving organizations other than NASA and transfer current NASA biological and physical research to the NPO in future years.

- SOMD oversight of existing research projects will be phased out and the NPO will co-select/manage new peer-reviewed projects.
- As on-going work within the NASA research project offices is completed in future years, extension/renewal decisions should be made exclusively by the NPO.

Through the management partnership, research opportunities will be expanded to conduct research in life sciences, material sciences, biotechnologies, condensed matter physics, and thermal sciences (e.g., fluid mechanics, thermodynamics, heat transfer, and combustion). NASA will continue to support research to meet NASA requirements for exploration including astronaut health and serve as a test bed for the development and demonstration of technology for future space exploration missions.

The ISS Program multi-user systems support function is responsible for all payload physical, analytical and operations integration activities and for projecting available utilization resources and accommodations, tactical planning, and execution of the day-to-day ISS integrated research plan for all payloads, including NASA, international partners, and non-NASA users.



<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	International Space Station
<b>Program:</b>	International Space Station Program

### ***ISS Crew and Cargo Transportation***

Cargo and Crew Transportation provides services to and from the ISS, including services provided by international partners and commercial purchases. NASA has contracted with Roscosmos to purchase crew transportation through CY 2013. The ISS Program plans to purchase crew transportation services from Russia, as needed, until a domestic capability is available by 2016.

NASA has also contracted with domestic companies to provide cargo supply and return services beginning in CY 2011 via the Commercial Resupply Services (CRS) contract. The FY 2012 budget provides for the acquisition of cargo transportation through CY 2020, including cargo transportation for National Laboratory research payloads. SpaceX currently has four missions on its manifest and Orbital Sciences has three missions on its manifest. Both SpaceX and Orbital Sciences are making progress on their missions which are planned to begin in FY 2012.

In addition, proposed Exploration funding would develop U.S. commercial crew transportation that will ultimately be utilized by the ISS. The FY 2012 ISS budget does not include any specific funding to purchase commercial crew transportation services, but NASA has developed a funding strategy to accommodate purchase of commercial crew seats as the development activities progress and better estimates for those services become available. A new Mission Operations Sustainment line within SFS provides support for essential human spaceflight activities, including purchase of commercial seats and communications infrastructure capability, by addressing space operations requirements and risks for which precise costs cannot be known until after formal technical requirements, risk management approaches, and cost estimates are prepared.

**Mission Directorate:** Space Operations  
**Theme:** International Space Station  
**Program:** International Space Station Program

## Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
ISS construction complete.	International Space Station (ISS)	same
In concert with the International Partners, maintain a continuous crew presence on the ISS by coordinating and managing resources, logistics, systems, and operational procedures.	International Space Station	N/A
Fly the ISS spares, logistics, and utilization hardware as agreed to by the International Partners in the ISS transportation plan.	International Space Station	N/A
Complete at least two flights to the ISS by U.S. developed cargo delivery systems.	International Space Station	N/A
Provide 100 percent of planned on-orbit resources (including power, data, crew time, logistics, and accommodations) needed to support research.	International Space Station	N/A
Achieve zero Type-A (damage to property at least \$1 million or death) or Type-B (damage to property at least \$250 thousand or permanent disability or hospitalization of three or more persons) mishaps.	International Space Station	N/A
Accomplish a minimum of 90 percent of the on-orbit research objectives as established one month prior to a given increment, as sponsored by NASA, baselined for FY 2012.	International Space Station	N/A
Facilitate non-profit organization (NPO) implementation of its initial grants solicitation process.	International Space Station	N/A

## Implementation Schedule

Project	Schedule by Fiscal Year																Phase Dates		
	Prior	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Beg	End	
ISS																	Tech		
																	Form		
																	Dev	Oct-93	Sep-07
																	Ops	Oct-07	Sep-20
																	Res	Oct-11	Sep-20
																	Tech & Adv Concepts (Tech) Formulation (Form) Development (Dev) Operations (Ops) Research (Res) Represents a period of no activity for the Project		

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	International Space Station
<b>Program:</b>	International Space Station Program

## Program Management

The ISS Program Manager reports to the Associate Administrator for Space Operations at NASA Headquarters.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
On-orbit assembly and operations	NASA Johnson Space Center	NASA Johnson Space Center	Russian Federal Space Agency, European Space Agency, Japan Aerospace Exploration Agency, Canadian Space Agency, and Italian Space Agency.

## Acquisition Strategy

NASA extended the Boeing U.S. On-Orbit Segment contract until September 30, 2015. NASA has competed and awarded the ISS Mission Integration Contract (MIC) to Barrios Technology. MIC, with options, will be extended through 2017. NASA has competed and awarded the follow-on Cargo Mission Contract (CMC) to Lockheed Martin. The CMC basic period extends through March 31, 2014 with four one-year extension options. The Program Integration Contract has been in place since October 2009, continuing for up to five years.

NASA awarded commercial cargo transportation services to SpaceX and OSC through the CRS contracts on December 23, 2008. Initial activities have begun for cargo services beginning as early as CY 2011, with services available until early 2016. NASA has also extended its contract with Roscosmos to purchase crew launches through CY 2013 and crew rescue and return through mid 2014. NASA plans to continue to purchase Russian crew transportation services until a domestic capability is available. ESMD has funding to facilitate the development of a U.S. commercial crew space transportation capability with the goal of achieving safe, reliable, and cost effective access to and from LEO and the ISS.

## **Theme Overview**

As explorers, pioneers and innovators, NASA expands frontiers to inspire and serve America and to benefit the quality of life on Earth. Space and Flight Support (SFS) provides Agency-level capabilities that enable exploration and science. SFS programs are authorized as "Space and Flight Services" under the NASA Authorization Act of 2010.

The 21st Century Space Launch Complex Program (21st CSLC) at the Kennedy Space Center (KSC) is working to modernize KSC's launch facilities, and the Florida range, to play a key role in future space exploration for a wide range of users. This includes NASA test flights, commercial flights in support of ISS, and expendable launch vehicles in support of NASA payloads and robotic precursor missions. Based on understanding of the evolving requirements from the users at KSC, the program is developing a comprehensive ground infrastructure plan and potential ground investment activities to improve KSC launch operations for future and current non-NASA users of the range.

The Space Communications and Navigation (SCaN) Program provides the support structure to conduct exploration and science. SCaN manages multiple space communication networks including the Deep Space Network, the Space Network, and the Near Earth Network. SCaN provides the support to regulate, maintain, and grow NASA's space communications and navigation capabilities that support NASA's space missions. Whether NASA missions are providing data about Earth, focusing science instruments on cosmic phenomena, or exploring far regions in space, reliable communication with Earth-based control centers is key to mission success. As new spacecraft with different objectives and advanced technology are launched, communications needs change. SCaN modifies and evolves its space communications capabilities to ensure current and new mission requirements are met.

Human Space Flight Operations (HSFO) is comprised of Space Flight Crew Operations (SFCO) and Crew Health and Safety (CHS). SFCO provides trained crew for NASA human space flight endeavors and is responsible for Johnson Space Center (JSC) aircraft operations and aircrew training. CHS enables healthy and productive crew during all phases of space flight missions; provides comprehensive health care program for astronauts; prevents and mitigates negative long-term health consequences of space flight. With the last flights of Shuttle in FY 2011, HSFO is focused on post-Shuttle retirement requirements. NASA has enlisted the National Academies to conduct an independent study of the activities.

Mission Operations Sustainment supports future essential human spaceflight activities by addressing space operations requirements and risks whose costs will not be precisely known after formal technical requirements, risk management approaches, and cost estimates are prepared. In FY 2013 and beyond, Mission Operations sustainment will fund future commercial transportation services to the ISS and such other potential needs as potential future requirements for space communications and Space Shuttle transition and retirement. Space Operation's future functional requirements and risks will be addressed as programmatic requirements and prioritized through analysis and planning that will become specific budget requirements in the FY 2013 Budget request.

The Launch Services Program (LSP) is responsible for understanding the full range of civil space launch needs. LSP works with other Government agencies and the launch industry to ensure that safe, reliable, on-time and cost-effective launch opportunities are available on a range of launch systems.

The Rocket Propulsion Test (RPT) Program reviews, approves, and provides direction on rocket propulsion test assignments, capital asset improvements, test facility modernization and refurbishments, integration for multi-site test activities, identification and protection of core capabilities, and the advancement and development of test technologies.

<b>Mission Directorate:</b>	<b>Space Operations</b>
<b>Theme:</b>	<b>Space and Flight Support (SFS)</b>

### FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>727.7</u></b>	<b>-</b>	<b><u>699.8</u></b>	<b><u>1,156.8</u></b>	<b><u>1,168.7</u></b>	<b><u>1,122.2</u></b>	<b><u>1,067.5</u></b>
21st Century Space Launch Complex	0.0	-	128.0	139.1	130.2	31.0	42.9
Space Communications and Navigation	482.3	-	404.8	450.2	460.9	460.8	460.8
Human Space Flight Operations	104.0	-	84.1	85.5	85.0	87.3	87.4
Mission Operations Sustainment	0.0	-	0.0	400.4	409.4	459.1	391.4
Launch Services	89.4	-	46.0	43.1	44.1	44.6	45.7
Rocket Propulsion Test	43.3	-	36.8	38.4	39.0	39.4	39.4
Crew Health & Safety	8.8	-	0.0	0.0	0.0	0.0	0.0

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In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the program amounts shown above. The allocation to each program is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

## **Plans for FY 2012**

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### **21st Century Space Launch Complex**

Efforts for the 21st CSLC Program are intended to benefit NASA's current and future operations at KSC, but also to enhance the capabilities for non NASA users of the range. This new initiative focuses on upgrades to the Florida launch range, expanding capabilities to support commercial launch providers, and transforming KSC into a modern facility that is well positioned to support the next century of space exploration. Areas under consideration include modernization activities to support safer and more efficient launch operations, enhancing payload processing capabilities, relocating the KSC perimeter to facilitate certain private sector activities and operations, environmental remediation, and supporting the modernization of the launch range capabilities.

### **Space Communications and Navigation**

In FY 2012, the SCA N Program will continue to successfully provide space communications and navigation capabilities to all missions and continue to define future communications requirements. SCA N will also continue to advance cross support opportunities with foreign space agencies through the definition and adoption of common standards and protocols, as well as proceed with the implementation of infrastructure upgrades and continue the development of enabling capabilities and technologies. Milestones to be completed in FY 2012 include: completion of the TDRS K and L spacecrafts, in preparation for launch of Tracking and Data Relay Satellite (TDRS) K in December 2012 (or possibly as early as April 2012) and TDRS L in December 2013; infrastructure upgrades, including the Space Network Ground Segment and the Deep Space Network (DSN) Canberra Deep Space Communications Complex 34-meter Beam Wave Guide; and continued development of enabling capabilities and technology, including early 2012 launch of the Communications, Navigation, and Networking reConfigurable Testbed (CoNNeCT), and integration and testing for the Lunar Laser Communication Demonstration (LLCD) for a FY 2013 launch, hosted by Lunar Atmosphere and Dust Environment Explorer (LADEE).

### **Human Space Flight Operations**

HSFO is comprised of SFCO and CHS. For FY 2012, SFCO will provide crew expertise for future vehicle development as well as four ISS long-duration crew rotation missions by providing and maintaining an adequate number of astronauts with appropriate skills and experience. This will be accomplished by maintaining safe and effective aircraft operation, supporting human space flight program activities such as boards, and technical evaluations that require operational input and expertise, and representing NASA to the public directly and through media.

### **Launch Services**

LSP has five planned NASA launches in FY 2012 including: the National Polar-orbiting Operational Satellite System (NPOESS) Preparatory Project (NPP), the last NASA mission to be launched on a Delta II; the Mars Science Laboratory (MSL) on an Atlas V; the Nuclear Spectroscopic Telescope Array (NuSTAR) on a Pegasus XL; TDRS-K on an Atlas V; and the Radiation Belt Storm Probes (RBSP) mission on an Atlas V. In addition to processing, mission analysis, spacecraft integration and launch services of these missions, LSP will continue to provide support for the development and certification of emerging launch providers critical to supporting future NASA programs.

### **Rocket Propulsion Test**

RPT will continue to provide test facility management, and provide maintenance, sustaining engineering, operations, and facility modernization projects necessary to keep the test-related facilities in the appropriate state of operational readiness. RPT continues to use the established testing requirements from all of the RPT customers to identify excess and "at-risk" test facilities and will support decisions relative to test asset consolidation initiatives.

## **Relevance**

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### ***Relevance to national priorities, relevant fields, and customer needs:***

SFS provides the enabling capabilities required to advance space exploration and expand scientific knowledge of Earth and the universe.

The 21st CSLC Program enables a more efficient and affordable future access to space for an evolving multi-user community by modernizing and transforming the Florida launch and range complex at KSC.

SCaN provides able and dependable space communications and navigation capabilities vital to successfully conduct human and robotic space missions.

SFCO provides trained crew members for all NASA human space flight endeavors, brings expertise to resolve operational or development issues and plays a major role in the public advocacy of human space flight. CHS provides enhancements to the health care provision environment both in space and on the ground for the astronaut corps. CHS contributes to the medical and health certification of astronauts before flight and the provision of care throughout their careers.

LSP enables access to space for NASA and other select Government missions. LSP provides safe, reliable, cost-effective, and on-time commercial launch services for NASA and NASA-sponsored payloads using ELVs.

RPT capabilities continue to support safe operation of the Space Shuttle through retirement, and provides test facilities for use by Department of Defense (DoD) and commercial programs. RPT facilities are part of the critical path for the development of future propulsion technologies required to support developing vehicle architectures.

### ***Relevance to the NASA Mission and Strategic Goals:***

21st CSLC supports NASA's Strategic Goal 5, to "Enable program and institutional capabilities to conduct NASA's aeronautics and space activities," by transforming the Florida Launch and Range Complex to provide a robust launch complex for NASA and future users.

HSFO supports NASA's Strategic Goal 1, to "Extend and sustain human activities across the solar system," by providing adequate numbers of healthy, productive, and assignable crew members during all phases of space flight missions.

RPT and LSP also relate to NASA's Strategic Goal 5, to "Enable program and institutional capabilities to conduct NASA's aeronautics and space activities."

### ***Relevance to education and public benefits:***

The benefits of SFS to education and the public include the return of scientific and educational data from space to Earth, the safe launching of expendable launch vehicles necessary for research, the assurance that rocket systems have been adequately tested, and the testing and implementation of various human health and illness prevention measures.

SFCO assigns astronauts for requested appearances and supplying the accompanying presentation materials. Astronauts support numerous public appearances sharing information about current and future space missions with the general public.

## Performance

### Performance Commitments:

Measure #	Description	Contributing Program (s)
<b>Strategic Goal 5</b>	<b>Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.</b>	
<b>Outcome 5.3</b>	<b>Ensure the availability to the Nation of NASA-owned, strategically important test capabilities.</b>	
<b>Objective 5.3.1</b>	<b>Work with the National Rocket Propulsion Test Alliance to identify NASA, Department of Defense and commercial capabilities and requirements.</b>	
<b>Performance Goal 5.3.1.1</b>	<b><i>Develop and execute the Rocket Propulsion Test (RPT) Master Plan.</i></b>	
APG 5.3.1.1: SFS-12-1	Meet Rocket Propulsion Test (RPT) Master Plan requirements for year one.	Rocket Propulsion Test
<b>Outcome 5.4</b>	<b>Implement and provide space communications and launch capabilities responsive to existing and future science and space exploration missions.</b>	
<b>Objective 5.4.1</b>	<b>Ensure reliable and cost-effective access to space for missions critical to achieving the National Space Policy of the United States of America.</b>	
<b>Performance Goal 5.4.1.1</b>	<b><i>Complete Launch Services Program (LSP) objectives for all NASA-managed expendable launches.</i></b>	
APG 5.4.1.1: SFS-12-2	Sustain 100 percent success rate with the successful launch of NASA-managed expendable launches as identified on the Launch Services Flight Planning Board manifest.	Launch Services
<b>Performance Goal 5.4.1.2</b>	<b><i>Continue utilizing existing contract mechanisms and agreements with emerging launch vehicle providers to gain information for future Launch Service orders and to provide technical exchanges to enhance early launch success.</i></b>	
APG 5.4.1.2: SFS-12-3	Incorporate information sharing processes into programmatic policies and incorporate into crew demonstration activities and future crew transportation service contracts.	Launch Services
<b>Objective 5.4.2</b>	<b>Transform the Florida launch and range complex to provide a robust launch and range infrastructure for future users.</b>	
<b>Performance Goal 5.4.2.1</b>	<b><i>By FY 2014, enable future government and commercial launching and testing from the Florida launch and range complex.</i></b>	
APG 5.4.2.1: SFS-12-4	Implement FY 2012 milestones within the 21st Century Space Launch Complex (21st CSLC) plan.	21st Century Space Launch Complex



## Performance

### Performance Commitments:

Measure #	Description	Contributing Program (s)
<b>Objective 5.4.3</b>	<b>Build and maintain a scalable, integrated, mission support infrastructure that can readily evolve to accommodate new and changing technologies, while providing integrated, comprehensive, robust, and cost-effective space communications services at order-of-magnitude higher data rates to enable NASA's science and exploration missions.</b>	
<b>Performance Goal 5.4.3.1</b>	<b>By 2014, launch two functionally identical Tracking and Data Relay Satellite (TDRS) spacecraft in geosynchronous orbits to replenish the Tracking and Data Relay Satellite System (TDRSS) constellation.</b>	
APG 5.4.3.1: SFS-12-5	Complete Tracking and Data Relay Satellite (TDRS) K Pre-ship review.	Space Communications and Navigation
<b>Performance Goal 5.4.3.2</b>	<b>By FY 2016, replace or upgrade obsolete and unsustainable systems of the Tracking and Data Relay Satellite System (TDRSS) Ground Segment at the White Sands Complex (WSC).</b>	
APG 5.4.3.2: SFS-12-6	Complete the Space Network Ground Segment Sustainment (SGSS) Preliminary Design Review (PDR).	Space Communications and Navigation
<b>Performance Goal 5.4.3.3</b>	<b>By FY 2018, replace aging and obsolete Deep Space Network (DSN) 70-meter antenna at Canberra Deep Space Communications Complex (CDSCC).</b>	
APG 5.4.3.3: SFS-12-7	Complete Deep Space Station-35 (DSS-35) antenna fabrication at vendor.	Space Communications and Navigation

***Performance Achievement Highlights:***

During FY 2010, SCaN continued to develop a unified space communication and navigation network capable of meeting both robotic and human exploration needs. During FY 2010:

- CoNNeCT and LLCD technology projects successfully completed Critical Design Reviews;
- The Space Network (SN) supported missions at or above 99.9 percent proficiency, exceeding official requirements. Supported missions included the Space Shuttle, ISS, Hubble Space Telescope, and Terra Earth science;
- A contract award was made for SN Ground Segment Sustainment to provide major Ground Segment modernization upgrades and provide a framework for further SCaN networks integration towards a single network;
- DSN supported missions at or above 95 percent proficiency for both telemetry and command, exceeding requirements. Supported missions included the Cassini, Kepler, Mars Reconnaissance Orbiter, and the Mars Exploration Rovers. (A contract for the 70 meter antenna replacement project was awarded in the first quarter of FY 2011.);
- The Near Earth Network supported missions at or above 99.1 percent proficiency, above requirements. Supported missions included the Lunar Reconnaissance Orbiter, Solar-B, and the Aqua and Aura Earth science missions. The Space Communications Network Services contract was awarded to support the operation, maintenance, and sustainment of the Space and Near Earth Networks;
- LSP successfully launched the Solar Dynamics Observatory and served in an advisory role for the Geostationary Operational Environmental Satellite mission. LSP awarded the NASA Launch Services II Contract, which brought several new launch vehicles on board, enabling additional competition in the small to small/medium class range of launch services. Successful technical interchange meetings were held with SpaceX and Orbital Science Corp;
- The RPT Program maintained its ability to safely test rocket propulsion systems by evaluating requirements and focusing resources to complete those requirements, including assuring the accuracy of requirements through close coordination with the DoD;
- HSFO, through SFCO, provided trained crew members to successfully complete four Space Shuttle and three long duration ISS crew rotation missions, supported over 460 public outreach appearances on NASA's behalf. CHS further enhanced the Longitudinal Study of Astronaut Health and implemented a system that allows flight surgeons easy access to analysis of medical requirements. CHS identified and leveraged the development of clinical care capabilities, such as ultrasound units, and is developing new technologies for hazardous and/or extreme environments ranging from the battlefield to space exploration use; and

The 21st CSLC Program acquired input through formal Requests For Information from the broader space community providing information on near-and long-term needs that the Florida Launch Range complex, and Space Florida as a means to broaden the Agency's information acquisition activity. NASA evaluated the needs of the community as a whole and folded those potential requirements into the planning process. With the passage of the NASA Authorization Act of 2010, this project has broadened its focus to consider SLS processing and launch infrastructure.

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** 21st Century Space Launch Complex

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b>0.0</b>	<b>=</b>	<b>128.0</b>	<b>139.1</b>	<b>130.2</b>	<b>31.0</b>	<b>42.9</b>
21st Century Space Launch Complex	0.0	-	128.0	139.1	130.2	31.0	42.9

**Note:**

The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

## Program Overview

The 21st CSLC Program's primary objective is to modernize and transform the Florida launch and range complex at KSC to benefit current and future NASA programs along with other emerging users. Described as the "launch support and infrastructure modernization program" in the NASA Authorization Act of 2010, the 21st CSLC Program will develop and implement shared infrastructure and process improvements to provide more flexible, affordable, and responsive capabilities to a multi-user community. The 21st CSLC Program will focus on the life cycle of a launch complex as an integrated system (from development, activation, operations, maintenance of capabilities to manufacture, assemble, test, checkout, and launch) to enable more efficient operations and simplify access to space for NASA and non-NASA users.

## Plans For FY 2012

The 21st CSLC Program will continue to develop and establish necessary partnerships in order to gain an understanding of evolving requirements from the users of the launch and range complex. The 21st CSLC Program will develop a cost-effective ground infrastructure plan that considers the space launch system and potential ground investment activities with the NASA Centers. In addition, NASA will pursue opportunities to partner or leverage investments planned by other mutually benefitting parties within the space user community. Based on available resources, areas under consideration for future cooperative efforts include modernization activities to support safer and more efficient launch operations, enhancing payload processing capabilities, relocating the KSC perimeter to facilitate certain private sector activities, operations environmental remediation, and supporting the modernization of the launch range capabilities.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	21st Century Space Launch Complex

## Project Descriptions and Explanation of Changes

### ***Mission Focused Modernization***

Modernization of systems necessary for vehicle integration and launch, horizontal takeoff and landing, vertical takeoff, and landing

### ***Range Interface and Control Services***

Modernization of range systems including command and control, communications, telemetry and tracking, and weather

### ***Environmental Remediation and Technologies***

Performance of environmental planning and compliance, energy reduction, sustainability, material replacement, remediation, and green or energy saving projects

### ***Offline Manufacturing, Processing and Recovery Systems***

Modernization of systems necessary for off-line payload processing, launch vehicle processing, laboratory testing, hazardous operations and servicing, and recovery

### ***Florida Infrastructure Modernization***

Modernization of systems or infrastructure necessary to support missions including power and utilities, transportation, safety and security, information technology, propellants, gases, and life support

## Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
Continue implementation of a focused investments plan enabling future government and commercial launching and testing from the Florida Launch and Range Complex beginning no earlier than FY 2014.	21st Century Space Launch Complex	
Implement FY 2012 milestones within the 21st Century Space Launch Complex (21st CSLC) plan.	21st Century Space Launch Complex	N/A

## Program Management

The 21st CSLC Program Manager reports to the Associate Administrator for Space Operations at NASA Headquarters.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	21st Century Space Launch Complex

## Acquisition Strategy

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The 21st CSLC Program will encompass projects with varying content and sizes. Many of the projects are consistent with the type of architecture and engineering, construction, and programmatic support available within the scope of existing Center and program support contracts.

## Independent Reviews

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Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Other	NASA Advisory Council	07/2010	Provides independent guidance for the NASA Administrator. No formal recommendations were provided.	TBD

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Space Communications and Navigation

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>482.3</u></b>	<b>-</b>	<b><u>404.8</u></b>	<b><u>450.2</u></b>	<b><u>460.9</u></b>	<b><u>460.8</u></b>	<b><u>460.8</u></b>
Space Communications Networks	363.3	-	348.7	382.5	401.8	408.9	408.3
Space Communications Support	93.5	-	55.1	56.3	59.1	51.9	52.4
TDRS Replenishment	25.4	-	1.0	11.4	0.0	0.0	0.0

**Note:**

The FY 2011 President's Budget request numbers in the FY 2010 column reflects the Initial Operating Plan budget numbers to be submitted to Congress.

The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Space Communications and Navigation

## Program Overview

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Today's spacecraft are increasingly powerful, complex, and capable of acquiring and processing ever increasing amounts of mission data. They can even employ artificial intelligence systems, enabling autonomous decision making. However complex and sophisticated these machines have become, two key functions have not changed: the needs to communicate with Earth and navigate in space. A failure of space communications and navigation on the spacecraft or on Earth could result in a complete loss of a mission. Hence, space communications and navigation is a fundamental capability of missions that depends on a high quality of hardware and software on both the spacecraft and the ground facilities. NASA's space communications and navigation capabilities rely on ground- and space-based assets that enable near Earth and deep space missions, as well as those of the other U.S. agencies and international partners. These national assets are managed as dedicated projects within SCA<sub>N</sub>. SCA<sub>N</sub> manages these assets for the Agency and strives for a cost efficient approach to effectively meet all missions' needs throughout all stages of their life.

SCA<sub>N</sub> is responsible for all Spectrum Management and Data Standards policy, oversight, and management for the Agency. It represents NASA before all domestic and international regulatory or technical bodies dealing with Spectrum and/or Data Standards, thus providing NASA with an integrated approach to promoting and safeguarding its SCA<sub>N</sub> equities and interests. Additionally, SCA<sub>N</sub> leads all NASA activities associated with present and future navigation technology and capabilities such as supporting spacecraft tracking and position determination.

These seemingly disparate functions, sustainment of existing assets, technology development, spectrum management, and international standards, are integrated through a robust System Engineering and Integration (SE&I) activity. This assures uninterrupted SCA<sub>N</sub> capabilities and prevents adverse impacts or data losses to science or exploration missions. In addition, SE&I conducts long-range planning based on projected mission needs and identifies technical performance targets for new technologies such as Disruption Tolerant Networking (DTN), Optical Communications, and Software Defined Radio.

By planning, developing, operating, and maintaining space and ground networks of tracking and data systems, SCA<sub>N</sub> services the Nation's space missions, both crewed and robotic, from LEO to the fringes of the solar system. For more information, please see <https://www.spacecomm.nasa.gov/spacecomm/>.

## Plans For FY 2012

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In FY 2012, SCA<sub>N</sub> will continue to provide space communications and navigation capabilities to all missions and continue to define and coordinate future communications requirements for NASA and other users. SCA<sub>N</sub> will also continue to advance cross-support opportunities with foreign space agencies through the definition and adoption of common standards and protocols. SCA<sub>N</sub> will proceed with the implementation of infrastructure upgrades and continue the development of enabling capabilities and technologies. Milestones to be completed in FY 2012 include: completion of the TDRS K and L spacecraft, in preparation for launch of TDRS K in December 2012 (and possibly as early as April 2012) and of TDRS L in December 2013; infrastructure upgrades including the SNGS and the DSN Canberra Deep Space Communications Complex 34-meter Beam Wave Guide; continued development of enabling capabilities and technology, including early 2012 launch of CoNNeCT, and integration and testing for LLCD for a FY 2013 launch, hosted by LADEE.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Space Communications and Navigation

## **Project Descriptions and Explanation of Changes**

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### ***Space Communications Networks***

The DSN consists of three facilities spaced approximately 120 degrees apart on the globe enabling continuous communications to spacecraft as the Earth rotates. The facilities are located in Spain, Australia, and California. DSN stations are NASA-owned assets managed by the DSN Project Office at the Jet Propulsion Laboratory (JPL). To maintain facility assets, SCA N utilizes funds appropriated for Construction of Facilities (CoF) to provide minor revitalization of the three DSN facilities. A list of the total CoF projects is included in the Construction and Environmental Compliance and Restoration section of this document.

Near Earth Network (NEN) consists of globally distributed tracking stations that are strategically located to maximize the communications service coverage provided to flight missions. The stations are located in Norway and Alaska, with additional antennas located at Wallops Island, Virginia, and Merritt Island, Florida. The NEN Project Office at GSFC manages the network, which includes both commercially owned assets and NASA facilities. NEN provides communications services to a variety of missions in certain orbital and suborbital locations, including LEO, Geosynchronous Earth Orbit (GEO), lunar, and highly elliptical orbits. SCA N is evaluating implementing higher data rate capability in the Ka-band to meet the evolving needs of future NASA missions and to reduce the mission load on the X-band that is limited in capacity.

The Space Network (SN) is a combination of TDRS System (TDRSS) and a set of supporting Space-to-Ground Link Terminals (SGLT) located at White Sands, New Mexico, and the Guam Remote Ground Terminal (GRGT). The ground terminals transmit signals to and from the TDRSS, which in turn relays those signals to and from flight missions. The SN predominantly supports LEO missions with global coverage, but it can also support launch vehicles and provide communications services to researchers in remote locations on Earth, such as the South Pole. The SN has proven to be an effective national asset meeting critical NASA and U.S. needs.

SN Ground Segment Sustainment (SGSS) is responsible for replacing outdated equipment and standardizing systems at all SN ground locations. The ground locations are White Sands and Guam. After replacement, the SGLT equipment at each SN ground station will be capable of supporting any spacecraft in the TDRSS fleet. A key objective of SGSS is to establish the capabilities required to support future space exploration vehicles.

The NASA Integrated Services Network (NISN) has a commercial service framework that provides point-to-point terrestrial signal transport services and routing network services. The Chief Information Officer has management responsibility for this project.



<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Space Communications and Navigation

### ***Space Communications Support***

Space Communications Support manages crosscutting communication functions, responsible for defining and protecting the integrity of the overall SCaN architecture, including identifying, assessing, and establishing policy or response to external policies. These functions include Spectrum Management, Systems Planning, and advanced concept enabling technology such as Optical Communications and DTN.

- Spectrum Management ensures the availability and allocation of radio frequency spectrum for all Agency programs, supporting the operation of navigation systems, space and ground based radio transmission, and mission active and passive remote sensing requirements.
- Systems Planning develops the communications and navigation architecture to support Agency Exploration and Science programs through FY 2030. This includes: Space Data Standards, which pursues the implementation of national and international space data standards with the aim of improved interoperability; Technology, which aims to predict the needs of future communications missions in a manner that will yield initiatives with performance enhancements with reduced costs; and Systems Engineering, which coordinates all SCaN systems engineering activities and manages the requirements that enable NASA to fulfill its space communications and navigation needs for future missions.
- An important part of the SCaN Technology Program is optical communications technology development and demonstration. The first NASA demonstration of this technology will be during the LADEE mission, which is scheduled to launch in May 2013. The optical communication capability would provide NASA with a high rate communication technique for deep space mission data with an objective of at least a 10-fold data rate increase over that achievable with RF technology. This revolutionary technology will provide higher data rates for less space, weight, and power burden compared to RF technology. Higher data rates will allow more science spacecraft to share the same Earth-based optical receivers, and enable greater science return over spacecraft life.
- Another SCaN Technology program effort currently in the demonstration phase is DTN. Two DTN nodes have been installed on ISS and initial demonstration results indicate significant productivity gains through automation of data transfers in the ISS's disruptive communications environment. DTN has also been demonstrated in a deep space environment during FY 2009 aboard the EPOXI spacecraft. A more rigorous second demonstration is planned for FY 2011 and is expected to show that data transport efficiency can be improved 100 percent. International standardization of DTN protocols will be moved forward by the SCaN Standards program along with other communication data standards that provide a sound base for interoperability of NASA missions with other International space agencies.

In addition, SCaN provides subject matter expertise to the NASA Deputy Administrator for the Deputy Secretary-level Positioning, Navigation, and Timing (PNT) Executive Committee that manages the U.S. Global Positioning System (GPS). GPS is a critical infrastructure component for NASA human spaceflight and science, and enables greater autonomous navigation of spacecraft while reducing the operational and cost burdens of traditional two-way ranging and tracking.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Space Communications and Navigation

### ***Tracking and Data Relay Satellite (TDRS) Replenishment***

The TDRS Replenishment project is responsible for the acquisition of TDRS-K and TDRS-L to replenish the aging fleet of communications spacecraft in the SN. The TDRS-K and TDRS-L Project Office at GSFC is managing the procurement, which includes on-orbit acceptance of two spacecraft. TDRS-K and TDRS-L. TDRS-K currently is set to be launched in December 2012, although NASA is evaluating the possibility of launching the satellite in April 2012. TDRS-L is scheduled to launch in December 2013. Modifications of the SGLT equipment at the White Sands Complex are included. In July 2009, the TDRS Replenishment project completed Key Decision Point (KDP)-C, and the development documentation was approved. SN meets critical NASA and U.S. needs that cannot be supported by commercial providers or any other U.S. assets. NASA is presently using the TDRS reliability model in consultation with TDRS users to assess future requirements for the TDRS constellation and assess future options.

### **Program Commitments**

<b>Commitment/Output FY 2012</b>	<b>Program/Project</b>	<b>Changes from FY 2011 PB Request</b>
Achieve less than three percent of lost operating time on NISN available services.	NASA Integrated Services Network, NISN	Same
Achieve at least 98 percent Network proficiency for delivery of Space Communications services.	Space Network, Deep Space Network, and Near Earth Network	Same
Complete Tracking and Data Relay Satellite (TDRS) K Payload and Bus Integration and test.	TDRS K	N/A
Complete the Space Network Ground Support Sustainment (SGSS) Integrated Baseline Review (IBR) and Systems Requirements Review (SRR).	Space Communications and Navigation	N/A
Complete Deep Space Station-35 (DSS-35) Pedestal Excavation and Azimuth track at Canberra Deep Space Communications Complex (CDSCC).	Space Communications and Navigation	N/A
Complete Tracking and Data Relay Satellite (TDRS) K Pre-ship review.	TDRS K	N/A
Complete the Space Network Ground Segment Sustainment (SGSS) Preliminary Design Review (PDR).	Space Communications and Navigation	N/A
Complete Deep Space Station-35 (DSS-35) antenna fabrication at vendor.	Space Communications and Navigation	N/A

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Space Communications and Navigation

## Implementation Schedule

Project	Schedule by Fiscal Year															Phase Dates		
	Prior	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Beg	End
Space Communications and Navigation Operations																	Tech	
																	Form	
																	Dev	
																	Ops	Oct-05 Oct-20
																	Res	
TDRS Replenishment - TDRS K																	Tech	
																	Form	Oct-07 Jul-09
																	Dev	Jul-09 Jul-12
																	Ops	Aug-12 Aug-27
																	Res	
TDRS Replenishment - TDRS L																	Tech	
																	Form	Oct-07 Jul-09
																	Dev	Jul-09 May-13
																	Ops	Jun-13 Jun-28
																	Res	
<div> <div></div> Tech &amp; Adv Concepts (Tech)  <div></div> Formulation (Form)  <div></div> Development (Dev)  <div></div> Operations (Ops)  <div></div> Research (Res)  <div></div> Represents a period of no activity for the Project </div>																		

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Space Communications and Navigation

## Program Management

The Deputy Associate Administrator for SCan reports to the Associate Administrator for SOMD at NASA Headquarters. SCan projects are managed from NASA Headquarters.

<b>Project</b>	<b>Management Responsibility</b>	<b>NASA Center Performers</b>	<b>Cost-Sharing Partners</b>
Deep Space Network	Space Communications and Navigation Program Office - NASA Headquarters	Jet Propulsion Laboratory	N/A
Near Earth Network	Space Communications and Navigation Program Office - NASA Headquarters	Goddard Space Flight Center	N/A
SN Ground Segment Sustainment	Space Communications and Navigation Program Office - NASA Headquarters	Goddard Space Flight Center	U.S. Government Agencies
Network Integration and Engineering	Space Communications and Navigation Program Office - NASA Headquarters	Goddard Space Flight Center, Glenn Research Center, Jet Propulsion Laboratory	N/A
Space Network	Space Communications and Navigation Program Office - NASA Headquarters	Goddard Space Flight Center	U.S. Government Agencies
Space Communications Support	Space Communications Program Office - NASA Headquarters	Glenn Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Johnson Space Center	N/A
Optical Communications	Space Communications and Navigation Program Office - NASA Headquarters	Goddard Space Flight Center, Jet Propulsion Laboratory	U.S. Government Agencies
NASA Integrated Services Network	Space Communications and Navigation Program Office - NASA Headquarters	Goddard Space Flight Center, Marshall Space Flight Center	N/A
TDRS Replenishment	Space Communications and Navigation Program Office - NASA Headquarters	Goddard Space Flight Center, Kennedy Space Center	U.S. Government Agencies

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Space Communications and Navigation

## Acquisition Strategy

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NASA owns a large, established base of space communications assets located nationally, internationally, and in orbit near Earth and Mars. SCA<sub>N</sub> conducts acquisition planning with the objective of preserving the Government's past investments, and altering capability or capacity in response to mission needs and NASA SCA<sub>N</sub> architecture goals.

NASA conducts major SCA<sub>N</sub> acquisitions on a competitive basis. To meet mission support objectives and achieve the best value for the Government, mission suitability and cost criteria are appropriately weighted and evaluated for competitively awarded acquisitions. When feasible, NASA pursues commercially available space communications services and products in preference to developing NASA-owned systems. NASA may also consider unique technical capabilities and maintenance of core competency in the NASA work force during the "make versus buy" decision process. To further achieve best value for NASA and the U.S. Government, the Agency may place task orders on Government Wide Acquisition Contracts (GWAC).

## Independent Reviews

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Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Other	NASA Advisory Committee (NAC)	09/2009	SCA <sub>N</sub> was reviewed by the NAC in 2009. The NAC recommended that an independent study of space communications needs for science, exploration, and space operations be conducted. Initial studies have been performed and results are being incorporated in SCA <sub>N</sub> strategic planning.	10/2011

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Space Communications and Navigation  
**Project In Development:** TDRS Replenishment

## FY 2012 Budget Request

Budget Authority (\$ millions)	Prior	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b>369.0</b>	<b>25.4</b>	<b>-</b>	<b>1.0</b>	<b>11.4</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

*Note:*

*For the FY 2012 Budget Request, project life cycle estimates, required to meet the requirements of section 103 of the NASA Authorization Act of 2005 (P.L. 109-155; 42 U.S.C. 16613), have been consolidated in the Management and Performance Section of this document. This consolidation provides for a comparative analysis across projects, and the inclusion of corrective action plans for the projects that have exceeded their original baseline estimates by greater than fifteen percent.*

*The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.*

*In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.*

*In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.*

## Project Purpose

The existing TDRSS fleet supports tracking, data, voice, and video services to the ISS, space and Earth science missions, as well as other Government agency users. The total mission load is predicted to increase, which will require additional satellites to be added to the fleet. The existing fleet is aging and reliability analyses predict a shortage of flight assets to support NASA missions and the user community by FY 2011. To meet this requirement, in FY 2007, NASA began the acquisition of two additional spacecraft, TDRS-K and TDRS-L. TDRS-K is scheduled to be launched in December 2012, although NASA is evaluating the possibility of launching as early as April 2012. TDRS-L is scheduled for launch in December 2013. By adding these two spacecraft to the TDRSS fleet, continuity of service will be insured for NASA and other Government agency user missions through at least FY 2016. The TDRS Replenishment project supports future Agency requirements and technology initiatives consistent with the approved baseline of the SCan architecture.

## Project Parameters

TDRSS consists of in-orbit telecommunications satellites stationed at a geosynchronous altitude with associated ground stations located at White Sands and Guam. This system of satellites and ground stations is SN providing services for near-Earth user satellites and orbiting resources. SN supports spacecraft that depend on it for reliable services to continue their missions. The TDRSS constellation includes first and the second generation satellites.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Space Communications and Navigation
<b>Project In Development:</b>	TDRS Replenishment

### Project Commitments

The TDRS-K and TDRS-L spacecraft will be fully compatible and capable of functioning as a part of the existing TDRSS. Contract requirements are design, development, fabrication, integration, test, on-orbit acceptance, and launch vehicle and services. Launch dates for TDRS-K and TDRS-L are in December 2012 (or possibly as early as April 2012) and December 2013, respectively. The spacecraft are required to have an operational life of 11 years. The basic requirement will also include modification of the White Sands SGLT to provide compatibility with the new spacecraft.

Project Element	Provider	Description	FY 2011 PB Request	FY 2012 PB Request
TDRS Replenishment	NASA	Aging hardware replacement	Same	Same

### Schedule Commitments

The TDRS Replenishment project was approved for entry into Phase C, development, in July 2009. The launch vehicle and payload will be delivered to KSC for processing to meet the TDRS-K and TDRS-L launch dates.

Milestone Name	Confirmation Baseline	FY 2011 PB Request	FY 2012 PB Request
<i>Development</i>			
TDRS System Critical Design Review (CDR)	January 2010	N/A	Same
TDRS Systems Integration Review (SIR)	January 2011	N/A	Same
TDRS Flight Readiness Review (FRR)	November 2012	N/A	Same
TDRS K Launch Readiness Date (LRD)	December 2012	N/A	Same
TDRS L Launch Readiness Date (LRD)	December 2013	N/A	Same

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**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Space Communications and Navigation  
**Project In Development:** TDRS Replenishment

## Project Management

The Deputy Associate Administrator for SCan reports to the Associate Administrator for Space Operations at NASA Headquarters.

Project Element	Project Management Responsibility	NASA Center Performers	Cost-Sharing Partners
TDRS Replenishment	Space Communications and Navigation (SCAN) Program Office - NASA Headquarters	Goddard Space Flight Center, Kennedy Space Center	US Government Agencies

## Acquisition Strategy

The TDRS K and L project is providing follow-on and replacement spacecraft necessary to maintain and expand the Space network. The contract to build two additional TDRS spacecraft was awarded to Boeing Satellite Systems in December 2007. In addition to building the TDRS K and L spacecraft, the contract also includes the modifications to the White Sands Complex ground system required to support these new spacecraft. The contract also provides fixed price options to procure two additional satellites, and NASA is using the TDRS reliability model, in consultation with TDRS users, to assess future requirements for the TDRS constellation and determine whether the Government needs to exercise the options.

## Project Risk Management

Title	Risk Statement	Risk Management Approach and Plan
TDRS-K and TDRS-L Obsolescence Risk Management	Aging spacecraft requires replacement hardware by FY 2013. The mission load is predicted to exceed current capacity and will need additional spacecraft to provide enough capacity.	The project has awarded a firm fixed price with incentive fee contract as of December 2007 to Boeing Satellite Systems, Inc. Spacecraft will launch in December 2012 and December 2013, respectively.



<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Human Space Flight Operations

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b>104.0</b>	<b>=</b>	<b>84.1</b>	<b>85.5</b>	<b>85.0</b>	<b>87.3</b>	<b>87.4</b>
Human Space Flight Operations	104.0	-	84.1	85.5	85.0	87.3	87.4

*Note:*

The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

## Program Overview

In FY 2012, HSFO will include the ongoing SFCO and CHS efforts. HSFO will provide capabilities required for continued support of International Space Station and future support of human space exploration activities, including a number of unique human space flight capabilities and facilities that NASA needs to preserve after ISS construction is completed. Assessment of crew input will continue to be important for defining and guiding HSFO activities.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Human Space Flight Operations

## Plans For FY 2012

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SFCO provides trained astronauts for all of NASA human space flight endeavors. For FY 2012, the SFCO will support ISS long-duration crew rotation missions, which will include support of the first commercial delivery of cargo to the ISS under the Space Exploration Technologies contract. During FY 2012, SFCO will provide support and training for astronauts preparing for future flights to the ISS, as well as provide technical and safety panel support to development of future human space systems. To help NASA determine the role and size of the human space flight office after Space Shuttle retirement and ISS construction completion, NASA enlisted the National Academies to conduct an independent study of the office's activities. In particular, the study will look at the requirements for crew-related training facilities in addition to the currently required aircraft and training, and a cost-effective means of meeting or achieving requirements. Results are expected in time to inform the FY 2013 budget process.

Crew Health and Safety will continue to enable healthy and productive crew during all phases of space flight missions, implementation of a comprehensive health care program for astronauts, and the prevention and mitigation of negative long-term health consequences of spaceflight. CHS will continue to collect, maintain, and mine health data related to the long-term effects of space flight in order to enable the mitigation of those effects. This data will be useful to ongoing operations and assist human space exploration activities in defining requirements for assuring safe human space operations for future systems. CHS will also work to implement technologies for monitoring health status before, during, and after flight and assure that medical personnel and crew members are trained to best use those technologies.

## Project Descriptions and Explanation of Changes

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### ***Human Space Flight Operations***

In FY 2012, SFCO and CHS will be funded under the HSFO Program.

- SFCO provides trained astronauts for all of NASA human space flight endeavors and brings astronaut expertise to help resolve operations or development issues within the human space flight programs. SFCO is responsible for all JSC aircraft operations including aircrew training.
- CHS will continue to help develop and refine a standardized battery of clinical and physiological tests for all crew members. CHS will focus on developing and refining medical standards that are critical to meet the needs that will facilitate human space exploration activities. Similarly, real-time mission evaluation will continue to help define and deliver medical operations hardware for current programs and meet the needs of known architectures.

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Human Space Flight Operations

### Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
SFCO will provide trained astronauts for all U.S. human space flight endeavors and bring experienced astronauts expertise to help resolve operations or development issues.	HSFO/SFCO	same
CHS will provide the full suite of medical capabilities necessary for the health and safety of the astronauts, and to assure they are mission ready from a health perspective.	HSFO/CHS	same

### Program Management

The SFCO and CHS managers report to the Associate Administrator for SOMD at NASA Headquarters.

### Acquisition Strategy

The contracts supporting SFCO are the Aircraft Maintenance and Modification Program provided by the Computer Services Corporation and the Aircraft Simulation Provider contract with Lockheed Martin. The contract supporting CHS bioastronautics is provided by Wyle Labs.

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Human Space Flight Operations

## Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	NAC	10/2010	Provides independent guidance for the NASA Administrator. No recommendations were provided to SFCO at this time.	02/2011
Performance	National Academies	01/2011	Providing independent assessment of activities funded within the NASA Human Space Flight Operations program for the Associate Administrator for SOMD. Recommendations will inform FY 2013 budget decisions.	TBD
Performance	Aerospace Safety Advisory Panel	10/2010	Provides independent assessments of safety to the NASA Administrator. In their 2008 Annual Report, ASAP stated that they "strongly endorse the NASA position on not extending Shuttle operations beyond successful execution of the December 2008 manifest, completing the ISS." NASA will fly the Space Shuttle to complete the ISS and then retire the Shuttle.	02/2011
Performance	Institute of Medicine	03/2007	At the request of NASA, the Institute of Medicine established a committee and issued this report. The committee was charged with examining the process by which NASA establishes space flight health standards for human performance. It assured the transparency of the current process, as well as considering its validity and integrity, particularly related to ensuring worker safety and integrating stakeholder input.	TBD
Performance	Institute of Medicine	04/2009	This report examines NASA's plans to assemble the available evidence on human health risks of space flight and to move forward in identifying and addressing gaps in research. The committee provided recommendations to strengthen the content, composition, and dissemination of the evidence books.	TBD

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Mission Operations Sustainment

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>0.0</u></b>	<b>=</b>	<b><u>0.0</u></b>	<b><u>400.4</u></b>	<b><u>409.4</u></b>	<b><u>459.1</u></b>	<b><u>391.4</u></b>
Mission Operations Sustainment	0.0	-	0.0	400.4	409.4	459.1	391.4

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In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Mission Operations Sustainment

## Program Overview

Mission Operations Sustainment addresses future Space Operations functions that are essential to the NASA human spaceflight mission. These crucial functions cannot be separately budgeted for at this time because specifications and requirements have yet to be defined, cost estimates must mature, and technical and/or cost risks factors and uncertainties have not been sufficiently evaluated. In all cases, the needs are real, but it will not be until the FY 2013 budget process that accurate assessments of the scope and relative priority of the need will be understood well enough to justify specific allocation of resources. For example:

- The NASA Exploration Systems budget provides funds to facilitate development of U.S. commercial crew transportation capability to ISS, but neither Exploration nor Space Operations budgets specifically provide funds to purchase those services once developed. Even though NASA will purchase cost-effective commercial crew transportation services once they become available, NASA cannot allocate specific levels of resources for the services until development activities progress and better cost estimates become available; and

- NASA has identified a potential future gap between ongoing communication infrastructure capability and future demand. The NASA SN comprises a constellation of eight communications satellites and associated ground facilities providing global communications coverage to Earth orbiting spacecraft. Key components of the SN infrastructure have exceeded their useful design life and are deteriorating. Although the time of a failure is largely unpredictable, in some cases system components are already operating beyond their expected design life. In addition, future demand is not well known dependent on the needs and capabilities of other users. In order to ensure that future NASA mission communications requirements are met, the Mission Operations Sustainment Budget line may potentially be utilized to fund this performance gap, if it arises in FY 2013 or later, to mitigate impact on NASA and other users.

Overall, NASA's human spaceflight mission cannot be sustained without resources provided by Missions Operations Sustainment. Given the tight fiscal environment, development of the Mission Operations Sustainment line is the responsible way to position Space Operations as it faces several important outyear requirements and threats. This approach is similar to that proposed in prior FY 2011 Continuing Resolution bills. NASA has already begun and will continually perform the requisite technical, program analysis, and planning to separately budget the resources for presentation in the FY 2013 Budget request.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Launch Services

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b>89.4</b>	<b>-</b>	<b>46.0</b>	<b>43.1</b>	<b>44.1</b>	<b>44.6</b>	<b>45.7</b>
Launch Services	89.4	-	46.0	43.1	44.1	44.6	45.7

*Note:*

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In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

## Program Overview

Assuring reliable and cost-effective access to space for missions is critical to achieving NASA's goals. NASA has assigned responsibility for understanding the full range of civil space launch needs to the Space Operations' Launch Services Program (LSP). LSP works closely with other U.S. Government agencies and the launch industry to ensure that the most safe, reliable, on-time, cost-effective commercial launch opportunities are available on a wide range of launch systems. The program works with customers from universities, industry, government, and international partners from the earliest phase of a mission.

A key challenge for LSP is matching the launch capabilities to the needs of the different customers. Through various scientific missions, these customers seek to understand: the origins, evolution, and destiny of the universe; the nature of life in the universe and what kinds of life may exist beyond Earth's orbit; the solar system, both scientifically and in preparation for human exploration; and the Sun and Earth and the consequences of the Earth-Sun relationship for life on Earth. The program purchases fixed-price launch services from domestic suppliers and provides oversight to ensure that these valuable, one-of-a-kind missions safely leave Earth to explore this planet and the universe beyond.

Within LSP, NASA maintains critical skills that provide technical management of launch services on the full fleet of existing and new launch systems. For more information, please see <http://www.nasa.gov/centers/kennedy/launchingrockets/index.html>.

LSP also supports integration activities for the Alpha Magnetic Spectrometer (AMS) particle physics and astrophysics experiment planned for the International Space Station. AMS will look for dark matter, anti-matter, and strange matter. This experiment is sponsored by the Department of Energy and funded largely by international partners. AMS is scheduled to launch aboard STS-134 in FY 2011.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Launch Services

## Program Relevance

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LSP has five planned NASA launches including NPP, the last NASA mission to be launched on a Delta II, MSL on an Atlas V, NuSTAR on a Pegasus XL, TDRS-K on an Atlas V, and RBSP on an Atlas V.

- NPP is a joint mission with National Oceanic and Atmospheric Administration that extends key measurements in support of long-term monitoring of climate trends and of global biological productivity.
- MSL, which is mostly comprised of the Curiosity long-duration rover, is part of NASA's Mars Exploration Program. MSL is scheduled to launch from Cape Canaveral, Florida, in late 2011, and will arrive at a scientifically intriguing region of Mars in August 2012. The goal of Curiosity is to assess whether Mars ever had an environment capable of supporting microbial life and conditions favorable for preserving clues about life, if it once existed.
- NuSTAR is an explorer mission that will allow astronomers to study the universe in high energy X-rays. Launching in 2012, NuSTAR is expected to greatly exceed the performance of the largest ground-based observatories that have observed this region of the electromagnetic spectrum. NuSTAR will also complement astrophysics missions that explore the cosmos in other regions of the spectrum.
- TDRSS supports tracking, data, voice, and video services to the ISS, space and Earth science missions, as well as other Government agency users. The requirements are predicted to increase and the existing fleet is aging. Reliability analyses predict a shortage of flight assets to support NASA missions and the user community by FY 2011. As a result, TDRS-K has a scheduled launch date of December 2012; however, NASA is evaluating the possibility of launching as early as April 2012.
- RBSP is being designed to help with understanding the Sun's influence on Earth and near-Earth space by studying Earth's radiation belts on various scales of space and time.

In addition to processing, mission analysis, spacecraft integration, and launch services of the above missions, LSP will continue to provide support for the development and certification of emerging launch providers that will be critical to supporting NASA programs, continue providing engineering analysis and integration support for approximately 35 NASA missions in various stages of planning and development, and provide and telemetry and communication support to several DoD launches.



<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Launch Services

## Plans For FY 2012

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The LSP program has five planned NASA launches including: 1) NPOESS Preparatory Project (NPP), the last NASA mission to be launched on a Delta II; 2) Mars Science Laboratory (MSL) on an Atlas V; 3) Nuclear Spectroscopic Telescope Array (NuSTAR) on a Pegasus XL; 4) Tracking and Data Relay Satellite (TDRS-K) on an Atlas V; and 5) the Radiation Belt Storm Probes (RBSP) mission on an Atlas V. In addition to processing, mission analysis, spacecraft integration, and launch services of the above missions, LSP will continue to provide support for the development and certification of emerging launch providers that will be critical to supporting NASA programs.

The NPP is a joint mission with National Oceanic and Atmospheric Administration that extends key measurements in support of long-term monitoring of climate trends and of global biological productivity. MSL, aka Curiosity, is part of NASA's Mars Exploration Program, a long-term suite of robotic exploration of the Red Planet. MSL is scheduled to launch from Cape Canaveral, FL in late 2011, and arrive at a scientifically intriguing region of Mars in August 2012. The goal of Curiosity, a rolling laboratory, is to assess whether Mars ever had an environment capable of supporting microbial life and conditions favorable for preserving clues about life, if it once existed. NUSTAR is an explorer mission that will allow astronomers to study the universe in high energy X-rays. Launching in 2012, the NuSTAR mission will allow astronomers to study the universe in high energy x-rays and is expected to greatly exceed the performance of the largest ground-based observatories that have observed this region of the electromagnetic spectrum. NuSTAR will also complement astrophysics missions that explore the cosmos in other regions of the spectrum. TDRSS supports tracking, data, voice, and video services to the ISS, Space and Earth science missions, as well as other government agency users. The requirements are predicted to increase and the existing fleet is aging. Reliability analyses predict a shortage of flight assets to support NASA missions and the user community by FY 2011. As a result, TDRS-K has a scheduled launch date of December 2012; however, NASA is evaluating the possibility of launching as early as April 2012. RBSP is being designed to help with understanding the Sun's influence on Earth and near-Earth space by studying the Earth's radiation belts on various scales of space and time.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Launch Services

## Project Descriptions and Explanation of Changes

### ***Launch Services Program***

LSP provides the acquisition and program management of ELV missions using primarily domestic launch vehicles and associated standard services with mission unique options. These services are contracted through LSP at KSC. LSP assures that NASA retains the technical, management, and acquisition skills necessary to meet Agency and customer needs, and provides mission integration, technical, and launch management functions.

Manifesting and scheduling of payload launches are accomplished through the Flight Planning Board. LSP acquires launch services to meet the full range of requirements, ranging from finding space for small payloads as secondary payloads to the launch of dedicated payloads on a range of launch vehicles. LSP also provides technical management of the launch service, including planning, execution, and support for flight project customer requirements.

LSP provides engineering services and analysis for launch vehicle certification to maximize the mission success of commercially developed expendable launch services by employing a technical oversight approach that includes a combination of specified approvals and targeted insight. This element also provides for the coordination of mission-specific and fleet-wide launch vehicle analyses, hardware changes, and production oversight, assessments, and out-of-family anomaly resolution.

## Program Commitments

<b>Commitment/Output FY 2012</b>	<b>Program/Project</b>	<b>Changes from FY 2011 PB Request</b>
LSP is planning for 15 missions by FY 2015 and is providing an advisory role for six additional missions.	SMD - 13 missions, and SOMD - two missions	NO CHANGE
Sustain 100 percent success rate with the successful launch of NASA-managed expendable launches as identified on the Launch Services Flight Planning Board manifest.	Launch Services	N/A
Incorporate information sharing processes into programmatic policies and incorporate into crew demonstration activities and future crew transportation service contracts.	Launch Services	N/A

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Launch Services

## Program Management

The Launch Services Program Manager reports to the Assistant Associate Administrator for Launch Services, SOMD at NASA Headquarters.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Launch Services Acquisition and Management	LSP, Kennedy Space Center	Kennedy Space Center	Air Force, National Reconnaissance Office
Engine Assembly and Test	LSP, Kennedy Space Center	Stennis Space Center	Air Force, National Reconnaissance Office
Mission Planning and Integration	LSP, Kennedy Space Center	Kennedy Space Center	Science Mission Directorate, Exploration Systems Mission Directorate, Space Operations Mission Directorate, Department of Defense/Missile Defense Agency, and the National Oceanic and Atmospheric Administration
Vehicle Production Insight	LSP, Kennedy Space Center	Marshall Space Flight Center	Air Force, National Reconnaissance Office

## Acquisition Strategy

The NASA Launch Services (NLS) II contracts were awarded in September 2010 to Lockheed Martin Space Systems Company, Orbital Sciences, SpaceX, and United Launch Services, LLC. Under these contracts, the program will acquire services associated with launches of Athena, Pegasus, Taurus, Falcon, and Atlas launch vehicles. Services are provided on a multiple award indefinite delivery/indefinite quantity basis, spanning a ten-year period. Missions not presently under contract are competed among existing NLS II contractors through the use of a launch service task order mechanism. In addition to NLS II, Glory is the only active mission remaining under the Small Expendable Launch Vehicle Services contract with Orbital Sciences. Thirteen remaining missions will fly out under the terms of NLS I between FY 2011 and FY 2015.

The NLS II solicitation contains a provision that permits technology infusion or improvements. New offerors may seek an NLS II contract during open season that occurs each February and August. The NLS II contracts enable ordering of standard and non-standard services, as well as special studies and mission-unique modifications.

Integrated launch services are provided by the Analex Corporation through a hybrid fixed-price/cost contract that contains options to continue performance through September 2011. Payload processing for east coast missions is provided by Astrotech Space Operations. West coast payload processing is provided after a competitive selection by either Astrotech or Spaceport Systems International.

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Launch Services

#### Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Independent Program Assessment Office (IPAO) Assessment	08/2009	This was a non-advocate review of LSP to present information to Agency decision-making councils. The NASA IPAO Review Team found that LSP is a highly successful program compliant with Agency direction, policy, and directives.	2012

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Rocket Propulsion Test

## FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b>43.3</b>	<b>-</b>	<b>36.8</b>	<b>38.4</b>	<b>39.0</b>	<b>39.4</b>	<b>39.4</b>
Rocket Propulsion Testing	43.3	-	36.8	38.4	39.0	39.4	39.4

*Note:*

The FY 2011 appropriation for NASA was not enacted at the time that the FY 2012 Request was prepared; therefore, NASA is operating under a Continuing Resolution (P.L. 111-242, as amended). Amounts in the "Ann. CR FY 2011" column reflect the annualized level provided by the Continuing Resolution.

In accordance with the President's proposal to implement a five-year non-security discretionary spending freeze, budget figures shown for years after FY 2012 are notional and do not represent policy. Funding decisions will be made on a year-by-year basis.

In FY 2012 through FY 2016, civil service labor and expenses (CSLE) funds are administered within a single consolidated account in each of the appropriations, and not allocated within the project amounts shown above. The allocation to each project is reflected in the summary budget table included in the beginning of this budget request, which provides a full cost view. In FY 2010 and FY 2011, amounts are presented in full cost.

## Program Overview

The RPT Program is the principal implementing authority for NASA's rocket propulsion testing. RPT reviews, approves, and provides direction on rocket propulsion test assignments, capital asset improvements, test facility modernizations and refurbishments. RPT provides integration for multi-site test activities, identification and protection of core capabilities, and the development of advanced test technologies.

RPT employs a collaborative approach to ensure rocket propulsion test activities are conducted in a manner that reduces cost, enhances safety, provides credible schedules, achieves technical objectives, and leverages the lessons learned. RPT reduces propulsion test costs through the safe and efficient utilization of rocket propulsion test facilities in support of NASA programs, commercial partners, and the DoD, while eliminating unwarranted duplication. RPT sustains and improves Agency-wide rocket propulsion test core capabilities (both infrastructure and critical skills) and ensures appropriate levels of capability and competency are maintained.

Additional information on the RPT program can be found at <http://rockettest.nasa.gov/>.

<b>Mission Directorate:</b>	Space Operations
<b>Theme:</b>	Space and Flight Support (SFS)
<b>Program:</b>	Rocket Propulsion Test

## Plans For FY 2012

NASA will continue to conduct test facility management, maintenance, sustaining engineering, operations, and facility modernization projects required to keep the test-related facilities in the appropriate state of operational readiness. RPT will maximize program resources by completing, implementing, and keeping the RPT master plan current, merging current and future requirements, budget resources, and capabilities to assure the Agency maintains a proper propulsion test portfolio. Right-sizing of test infrastructure (both critical skills and facilities) will be implemented within existing budget guidelines to meet all technical, schedule, and cost requirements, both current and future, to include dispositioning facilities that are no longer required. Commercial testing and facility maintenance projects (e.g., commercial testing of the AJ-26 Liquid Oxygen and Kerosene Engine and the Stennis Space Center High Pressure Industrial Water project) will be implemented, as funding priorities permit, to improve safety and operational efficiencies.

The RPT program will continue to assist in the rocket propulsion testing requirements definition for low Earth orbit and in-space propulsion systems and related technologies.

## Project Descriptions and Explanation of Changes

### ***RPT***

RPT represents the single point interface for NASA's rocket propulsion test facilities located at: Stennis Space Center (SSC), Marshall Space Flight Center (MSFC), JSC's White Sands Test Facility (WSTF), and GRC's Plum Brook Station (GRC-PBS). These facilities have a replacement value of greater than \$2 billion. RPT sustains and improves Agency-wide rocket propulsion test core competencies (both infrastructure and critical skills), ensures appropriate levels of capability and competency are maintained, and eliminates unwarranted duplication. The program strategy is to fund and maintain core competencies of skilled test and engineering crews and test stand facilities, consolidate and streamline NASA's rocket test infrastructure, establish and maintain world-class test facilities, modernize test facility equipment; provide non-project specific equipment and supplies, and develop effective facility/infrastructure maintenance strategies and performance. The RPT budget does not include resources to support the marginal costs of testing (e.g., direct labor, propellants, materials, program-unique facility modifications, etc.) since these activities are funded by programs as a direct cost when they utilize the RPT test stands. When NASA, DoD, and commercial partners use the RPT-supported test stands, they are responsible for program-specific facility modifications in addition to the active testing of the program-specific test article.

## Program Commitments

Commitment/Output FY 2012	Program/Project	Changes from FY 2011 PB Request
Commercial testing of AJ-26 engine	Orbital Sciences Corporation	NO CHANGE
Testing of the J-2X Engine	Upper Stage Engine (USE)	NO CHANGE
Minuteman Decommissioning	U.S. Air Force	NO CHANGE
PCAD Component Testing	Propulsion Cryogenics Advanced Development (PCAD)	NO CHANGE
Commercial testing of RS-68 engine	Pratt Whitney Rocketdyne/Air Force	NO CHANGE
Meet Rocket Propulsion Test (RPT) Master Plan requirements for year one.	Rocket Propulsion Test	N/A

**Mission Directorate:** Space Operations  
**Theme:** Space and Flight Support (SFS)  
**Program:** Rocket Propulsion Test

## Program Management

The Rocket Propulsion Testing Program Manager reports to the Assistant Associate Administrator for Launch Services, SOMD at NASA Headquarters.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Technical Services and Support	Stennis Space Center	Jacobs-Sverdrup, Mississippi Space Services	Rocket Propulsion Test Management Board Members: Stennis Space Center, Marshall Space Flight Center, Johnson Space Center, White Sands Test Facility, Glenn Research Center's Plum Brook Station, Kennedy Space Center (associate member), and Glenn Research Center (associate member). National Rocket Propulsion Test Management Board Department of Defense Members: Air Force Research Lab, Arnold Engineering Development Center, Redstone Technical Test Center, and Naval Air Warfare Center.

## Acquisition Strategy

The Test Operations contract was extended for seven months (from August 2010 to March 31, 2011). A successful recompetes was completed that included the consolidation of SSC Hardware Assurance and Test contract requirements to provide consolidation of test operations at SSC. Transition activities have begun with the new contractor and handover is expected on April 1, 2011.

<b>Mission Directorate:</b>	<b>Space Operations</b>
<b>Theme:</b>	<b>SOMD Civil Service Labor and Expenses</b>

### Theme Overview

This Theme contains labor funding, both salary and benefits, for civil service employees at NASA's Centers who are assigned to work on projects in SOMD. These funds support the critical skills and capabilities required to provide the space flight missions operations and services, as outlined in the other themes, within this mission area.

### FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
<b>FY 2012 President's Budget Request</b>	<b><u>0.0</u></b>	<b>-</b>	<b><u>343.4</u></b>	<b><u>348.5</u></b>	<b><u>360.2</u></b>	<b><u>377.5</u></b>	<b><u>395.6</u></b>
SOMD Civil Service Labor and Expenses	0.0	-	343.4	348.5	360.2	377.5	395.6